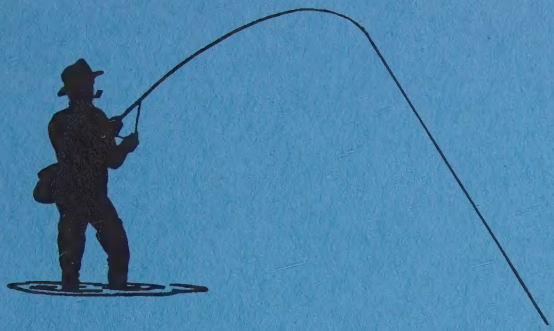

SPORT FISHERY ABSTRACTS

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14933. Wares, Paul G. (Tiburon Marine Lab., Tiburon, California). 1971. BIOLOGY OF THE PILE PERCH, Rhacochilus vacca, IN YAQUINA BAY, OREGON. U. S. Dept. of the Interior, Technical Papers of the Bureau of Sport Fish. & Wildl. No. 57, 21 p. For sale by Supt. of Documents, Wash., D. C., price 30 cents.

Growth, reproduction, food habits, and parasites of pile perch, Rhacochilus vacca (Girard), were investigated in Yaquina Bay, Oreg., between April 1966 and July 1967. The research disclosed that pile perch live at least 10 years. Males and females of given ages are close to the same size up to age IV, after which females are increasingly larger than males. Males and females respectively approach average ultimate sizes of 1,120 g at 430 mm and 2,000 g at 490 mm total length. Some females mature in their second year; 90 percent mature at age III. Some males also mature in their second year. Mating occurs in the fall; there is a delay of about 3 months before fertilization. The gestation period is about 6-1/2 months; most young are born between late June and early August. Fecundity increases with size and age of fish (observed range 7 to 61 embryos). Dead eggs and malformed embryos are occasionally found among healthy embryos, the occurrence of malformed embryos being inversely related to age of parent, the occurrence of dead eggs being independent of age of parent. Pile perch are carnivorous feeders, obtaining food from the bottom or protruding surfaces in the littoral zone. The diet varies between seasons and localities. Principal foods are barnacles, mussels, the bay clams, crabs, mud shrimp, and a tube dwelling amphipod. None of the pile perch examined was heavily parasitized. Infestations of gill copepods vary seasonally. (Auth.)

14934. Jester, Douglas B., and Buddy L. Jensen (New Mexico State Univ., Las Cruces, New Mexico). 1972. LIFE HISTORY AND ECOLOGY OF THE GIZZARD SHAD, Dorosoma cepedianum (Le Sueur) WITH REFERENCE TO ELEPHANT BUTTE LAKE. New Mexico State Univ. Agric. Exp. Sta. Research Report 218, 56 p.

The gizzard shad is highly esteemed as a forage fish in fluctuating impoundments which contain deep and relatively clear water, have abrupt shorelines, support little or no littoral vegetation, adequate plankton, sparse benthic flora and fauna, and contain sufficient predators to crop young-of-the-year shad. This is essentially a description of Elephant Butte Lake, except that predation is inadequate to prevent stunting. Growth rates of shad in Elephant Butte Lake have increased substantially since 1965-66 but are still slower than in most other waters studied. Time required for shad to attain a weight of 100 grams (3.5 ozs) in Elephant Butte Lake was longer than in any other water compared. Coefficients of condition of gizzard shad in Elephant Butte Lake were lower than those in 10 other waters from which comparisons were available. Gizzard shad spawned in Elephant Butte Lake from early May through late June at temperatures ranging from 17.8° to 23.9°C (64° to 75°F). A second spawn may occur in late summer. Shad spawned mostly in shallow water but were observed spawning at the surface where water was 50 feet (15 m) deep. Male shad matured in Age Groups II and III. Females matured in Age Groups III and IV. Twenty-seven fish in Age Group III contained an average of 40,500 ova. Three fish in Age Group IV contained an average of 29,884 ova and one fish in Age Group VI contained 58,467 ova. Phytoplankton comprised 36.8 percent and zooplankton made up 31.2 percent of the number of food items. Unidentified organic residue and higher plant material comprised 28.4 percent and 3.6 percent, respectively. Gizzard shad occupied the littoral and limnetic zones of the lake most often from April through October. They moved into deep water and became relatively inactive in the fall as the water cooled to 14°C (57.2°F) and became active in spring when the temperature warmed to 14°C. Gizzard shad were relatively free of parasites and diseases. The sport fishery in Elephant Butte Lake is dependent upon gizzard shad as a source of forage. All major game fish populations, except flathead catfish, utilized shad as 69 to 94 percent of the number of food items. Mass mortality of gizzard shad occurred in association with low temperature and extreme drawdown. Predation by introduced walleye and white bass populations has contributed to reduction of numbers of shad. Reduction of numbers has partially relieved stunting and growth rates have increased as intraspecific competition was reduced. Gizzard shad in

Elephant Butte Lake have greater value as forage to support game fish populations than they have for commercial fishing. Present abundance and continued stunting indicate that gizzard shad are still sufficiently numerous to support additional populations of game fishes. (From authors summ.)

14935. Evans, Douglas H., and Paul G. Wares (Tiburon Fish. Lab., Tiburon, California). 1972. FOOD HABITS OF STRIPED MARLIN AND SAILFISH OFF MEXICO AND SOUTHERN CALIFORNIA. U. S. Dept. of the Interior, Bureau of Sport Fish. & Wildl. Research Report 76, 10 p. For sale by Supt. of Documents, Wash., D. C., price 45 cents.

Stomach contents of 924 striped marlin (Tetrapturus audax) landed in the sport catches at Mazatlán, Sinaloa, and Buena Vista, Baja California Sur, Mexico, and San Diego, Calif., and of 197 sailfish (Istiophorus platypterus) from Mazatlán and Buena Vista were examined. The striped marlin and sailfish fed primarily on pelagic fishes and cephalopods. By volume the major foods were squid (principally Dosidicus gigas) for striped marlin at Mazatlán and for striped marlin and sailfish at Buena Vista, northern anchovy (Engraulis mordax) for striped marlin at San Diego, and threadfin (Polydactylus sp.) for sailfish at Mazatlán. Locality differences in food habits were pronounced, and some seasonal and yearly differences were found. (Authors)

14936. Edmunds, Philip H. (Narra. Marine Game Fish Res. Lab., Narragansett, Rhode Island). 1972. GENIC POLYMORPHISM OF BLOOD PROTEINS FROM WHITE MARLIN. U. S. Dept. of the Interior, Bureau of Sport Fish. & Wildl. Research Report 77, 15 p. For sale by Supt. of Documents, Wash., D. C., price 45 cents.

Over 100 white marlin (Tetrapturus albidus) were analyzed for each of seven proteins to discover genetically controlled variations that may be useful in subpopulation studies. The iron-binding plasma protein, transferrin, and the enzymes esterase, 6-phosphogluconate dehydrogenase (PGD), and malate dehydrogenase (MDH) each occur in multiple electrophoretically distinct forms: two of transferrin, two of esterase, five of PGD, and three of MDH. Transferrin, esterase, PGD, and MDH patterns differ from one marlin to another. Individual differences apparently reflect genic polymorphism: two codominant alleles at one autosomal locus controlling three transferrin patterns, two codominant alleles at another autosomal locus controlling three esterase patterns, three codominant alleles at a third autosomal locus controlling four PGD patterns, and two codominant alleles at a fourth locus controlling two MDH patterns. Hemoglobin and the enzymes lactate dehydrogenase (LDH) and glucose-6-phosphate dehydrogenase (G6PD) also occur in multiple electrophoretically distinct forms: six of hemoglobin, four of LDH, and one or two of G6PD. None of the three proteins exhibit genic variations. Geographical distributions of transferrin, esterase, PGD, and MDH variants as yet provide no reason to assign marlin from four widely separated areas in the western North Atlantic to different subpopulations. This fact and information about migrations and spawning activity suggest there are at least two subpopulations of white marlin: one in the western North Atlantic and one or more in the South Atlantic. (Auth.)

14937. Moe, Martin A., Jr. (Mar. Res. Lab., Fla. Dept. of Natural Resources, St. Petersburg, Florida). 1972. MOVEMENT AND MIGRATION OF SOUTH FLORIDA FISHES. State of Florida Dept. of Natural Resources Technical Series No. 69, 25 p.

Movement and migration patterns occurring in 42 families of South Florida marine fishes are summarized and discussed within the following categories: residentially restricted fishes, fishes with a broad residential range, fishes with restricted migratory patterns, and fishes with extensive migratory patterns. Migration is defined as a purposeful, concurrent movement of a major portion of the population and includes movement restricted temporally and spatially, as well as extensive seasonal movement. Reciprocity of movement is considered a consistent feature of migrations. Migrations are categorized as alimental, gametic, developmental, climatic, and osmoregulatory. Methods of investigating movement and migration in fishes are discussed. (Auth.)

14938. von Geldern, C. E., Jr. 1972. ANGLING QUALITY AT FOLSOM LAKE, CALIFORNIA, AS DETERMINED BY A ROVING CREEL CENSUS. Calif. Fish and Game 58(2): 75-93.

A creel census was conducted at Folsom Lake, California, on 96 days from January through December 1962, to obtain a measure of angling quality on this large west slope Sierran impoundment. Census clerks interviewed 11,022 anglers who fished 24,957 hr and caught 8,131 game fish. Bluegill (Lepomis macrochirus), smallmouth bass (Micropterus dolomieu), and largemouth bass (M. salmoides), dominated the catch. Fishing pressure was highest in spring and lowest in winter. Angler success was highest in summer and early fall. Estimated total use and catch during 1962 were 299,155 angler hours and 88,918 game fish. Evidence is presented which suggests that the black basses may be overexploited in relation to competing centrarchids. Other segments of the fishery, however, appear capable of supporting greater angler pressure. The value of detailed data on angling methodology as a means of more accurately describing the various segments of a complex multi-species fishery is conclusively demonstrated. (Auth.)

14939. Miller, Lee W. 1972. MIGRATIONS OF STURGEON TAGGED IN THE SACRAMENTO-SAN JOAQUIN ESTUARY. Calif. Fish and Game 58(2): 102-106.

A total of 2,692 white sturgeon (Acipenser transmontanus) and 54 green sturgeon (Acipenser medirostris) were tagged in 1967 and 1968. Tag returns from white sturgeon indicate that the population inhabits the lower estuary during the summer, fall and winter. An apparent spawning migration occurs during late winter and spring. Two green sturgeon were recaptured at the mouth of the Columbia River, one in Washington, one at Santa Cruz and one in the estuary. (Auth.)

14940. Espinosa, Lawrence R., and William E. Clark. 1972. A POLYPROPYLENE LIGHT TRAP FOR AQUATIC INVERTEBRATES. Calif. Fish and Game 58(2): 149-152.

During research on waterfowl botulism a trap was designed which proved very successful in collecting aquatic invertebrates. Construction features are illustrated. (Authors)

14941. Miller, Lee W. 1972. WHITE STURGEON POPULATION CHARACTERISTICS IN THE SACRAMENTO-SAN JOAQUIN ESTUARY AS MEASURED BY TAGGING. Calif. Fish and Game 58(2): 94-101.

Exploitation rates for Acipenser transmontanus were 0.073 and 0.065 for 1967 and 1968. These rates empirically seem low enough to provide adequate protection under existing regulations of one 40-inch sturgeon per angler day. Shedding of tags under the anterior portion of the dorsal fin was negligible, but shedding was significant for tags under the posterior portion of the dorsal fin. Most tag shedding occurred after the first year. The percentages of total tag returns returned by anglers using private boats, anglers fishing from party boats and shore anglers were 74.1, 20.5 and 5.4% respectively. The population size was estimated at 114,667 sturgeon. The 95% confidence interval was 72,384 to 212,293. (Auth.)

14942. Demory, Robert L. 1972. TAILLESS DOVER SOLE FROM OFF THE OREGON COAST. Calif. Fish and Game 58(2): 147-148.

Six Microstomus pacificus were noted in the period March 1966 to February 1968. The largest specimen was 199 mm. The specimens are illustrated. (Auth.)

14943. Rawstron, Robert R. 1972. NONREPORTING OF TAGGED LARGEMOUTH BASS 1966-1969. Calif. Fish and Game 58(2): 145-147.

Reward and non-reward tags were applied to Micropterus salmoides at Merle Collins Reservoir. Reward tags were turned in at a higher rate than non-reward tags. There was little difference in response for $5 reward tags and $1 reward tags. (Auth.)

14944. Healey, M. C. (Fish. Res. Bd. of Canada, Freshwater Inst., Winnipeg, Manitoba, Canada). 1972. INDIVIDUAL BEHAVIOR AND GROUP BEHAVIOR IN SOCKEYE SALMON (Oncorhynchus nerka). Fish. Res. Bd. of Canada Technical Report 297, 16 p.

14945. Earnest, Russell D., and Pete E. Benville, Jr. 1972. ACUTE TOXICITY OF FOUR ORGANOCHLORINE INSECTICIDES TO TWO SPECIES OF SURF PERCH. Calif. Fish and Game 58(2): 127-132.

The acute toxicities of endrin, DDT, aldrin and dieldrin to shiner perch (Cymatogaster aggregata) and dwarf perch (Micrometrus minimus) were determined by static and intermittent-flow bioassays. Toxicity was measured at the Median Lethal Concentrations (TL_{50}) for 96-hr exposures. TL_{50} values were lower in intermittent-flow bioassays than in static bioassays. We also compared residue concentrations in surviving and dead fish from the intermittent-flow bioassays. Residue concentrations in fish that died during tests were higher than those of fish that survived. However, the range of concentrations in dead and surviving fish overlapped. (Authors)

14946. Spratt, Jerome D. 1972. AGE AND LENGTH COMPOSITION OF NORTHERN ANCHOVIES, Engraulis mordax, IN THE CALIFORNIA ANCHOVY REDUCTION FISHERY FOR THE 1969-70 SEASON. Calif. Fish and Game 58(2): 121-126.

Anchovy landings totaled 83,472 tons during the 1969-70 season. Sampling revealed that the catch was dominated by age groups 0, I, and II in southern California, and age groups I and II in central California. (Auth.)

14947. Williams, Roy O., and Gerard E. Bruger (Mar. Res. Lab., Florida Dept. of Natural Resources, St. Petersburg, Florida). 1972. INVESTIGATIONS ON AMERICAN SHAD IN THE ST. JOHNS RIVER. State of Florida Dept. of Natural Resources Technical Series No. 66, 49 p.

A study of American shad, Alosa sapidissima (Wilson), in the St. Johns River was conducted to determine the spawning grounds, movement, growth, and food habits of juveniles, and to evaluate effects of the fisheries and proposed environmental alterations on the populations. Spawning grounds were located by collecting free-drifting, demersal shad eggs in plankton nets set along the river bottom. Spawning began at Crows Bluff west of Deland and extended south about 100 miles to U. S. Highway 192 west of Melbourne, but most spawning occurred between Lakes Monroe and Poinsett. Importance of the spawning area between Lakes Harney and Poinsett increased during low water when there was little current in the area north of Lake Harney. Eggs were generally collected over clean sand bottom of less than 4 m depth and in current of 1 - 1-1/2 ft/sec. Juvenile movement and growth were determined by monthly collections of young shad with beach seines, plankton nets, and trawls. Movement patterns were related to current and water temperature with downstream movement from spawning grounds to nursery area occurring as water temperatures increased in spring, and emigration from the river occurring when temperatures dropped in late autumn. Growth was more rapid during the 1970 season. Juveniles collected emigrating from the river in 1969 ranged from 69-110 mm FL. Young shad fed primarily on crustaceans and insect larvae; crustaceans were the dominant food type. Commercial and sport fisheries have changed significantly from accounts given by previous investigators. Production of both fisheries has declined in recent years. Gill nets are the primary commercial gear; onetime important hand seines are now nearly defunct. There is some evidence of overfishing, especially of female shad. Proposed upper river alterations such as the St. Johns-Indian River Canal and water control projects by the Central and Southern Florida Flood Control District are discussed and evidence is presented that they may reduce future shad runs by eliminating and/or degrading sections of spawning area between Lakes Monroe and Poinsett. (Authors)

14948. Sinclair, Norman R. (Marine Inst., Sapelo Island Georgia). 1972. STUDIES ON THE HETEROPHYID TREMATODE Apophallus brevis, THE "SAND-GRAIN GRUB" OF YELLOW PERCH (Perca flavescens) I. REDESCRIPTION AND RESOLUTION OF SYNONYMIC CONFLICT WITH Apophallus imperator Lyster, 1940 AND OTHER DESIGNATIONS. Canadian Journal of Zoology, 50(3): 357-364.

14949. Bullock, G. L. (Bur. of Sport Fish. & Wildl., Eastern Fish Disease Lab., Kearneysville, West Virginia). 1972. STUDIES ON SELECTED MYXOBACTERIA PATHOGENIC FOR FISHES AND ON BACTERIAL GILL DISEASE IN HATCHERY-REARED SALMONIDS. U. S. Dept. of the Interior, Technical Papers of the Bur. of Sport Fish. & Wildl., No. 60, 30 p., illus. For sale by the Supt. of Documents, Wash., D. C., price 35 cents.

Morphological, physiological, and serological studies on 55 myxobacteria isolated principally from gill disease, tail rot, and other myxobacterial infections showed that a variety of myxobacteria occur in these infections. Although there were different morphological types of myxobacteria, all strains from freshwater and estuarine sources were physiologically similar. Isolates from marine sources were physiologically less active than the other test organisms. Agglutinin reactions of test myxobacteria showed many types; serological relationships of many of the test strains to Chondrococcus columnaris and Cytophaga psychrophila were shown by the agar gel precipitin reactions. Studies on fingerling trout showed that gill disease can be induced within 2 weeks by crowding, exposure to ammonia and low oxygen, and factors not measured. When live diseased fingerlings were added to aquarium water containing stressed trout the disease occurred within a week; attempts to transmit gill disease to stressed trout with cultures of myxobacteria, with other eubacteria isolated from diseased tissue, or with dead diseased fingerlings were unsuccessful. Bacterial gill disease failed to develop in trout exposed to 0.5-2.5 ppm ammonia, 4.0-5.0 ppm dissolved oxygen, or to both ammonia and low oxygen. Three species of yearling trout from four hatcheries were found to have low levels of agglutinins against myxobacteria isolated from gill disease, tail rot, and trout skin. Cross absorption studies with 10 of these cultures indicated common antigens. (Auth.)

14950. Rucker, Robert R. (Bur. of Sport Fish. & Wildl., Western Fish Disease Lab., Seattle, Washington 98115). 1972. GAS-BUBBLE DISEASE OF SALMONIDS: A CRITICAL REVIEW. U. S. Dept. of the Interior, Technical Papers of the Bur. of Sport Fish. & Wildl., No. 58, 11 p. For sale by the Supt. of Documents, Wash., D. C., price 25 cents.

Fish maintained in water supersaturated with air reach equilibrium with the gases dissolved in water. These gases in the fish tend to equilibrate to the atmosphere the same as the gases in the water. Gas-bubble disease is characterized by bubbles under the skin, in the fins, tail, mouth, behind the eyeballs, and in the vascular system. Carbon dioxide does not cause gas-bubble disease. Oxygen can cause gas-bubble disease at about 350 percent air saturation, but nitrogen can cause the disease even below 118 percent air saturation. Excess gas in water can be produced by pressure, increase in temperature, and biotic metabolism, and can be reduced by exposure to air. Carbon dioxide and oxygen can be quantitated by titrimetry, while nitrogen analysis requires manometry, gas chromatography, or mass spectrometry. Saturation tables for atmospheric oxygen and nitrogen in water for 0° to 30° C. are presented. (Auth.)

14951. Florinskaya, A. A. 1969. DATA ON THE SPECIES COMPOSITION AND ECOLOGY OF MOLD FUNGI - AGENTS OF SAPROLEGNIOSIS OF FISH OF THE LENINGRAD DISTRICT (Materialy po vidovomu sostavu i ėkologii plesnevykh gribov - vozbuditeleĭ Saprolegniozov ryb Leningradskoĭ oblasti). Infektsionnye bolezni ryb i bor'ba s nimi. Izvestiya Gosudarstvennogo Nauchno-Issledovatel'skogo Instituta Ozernogo i Rechnogo Rybnogo Khozyaĭstva, Vol. 69, Ministerstvo Rybnogo Khozyaĭstva RSFSR, Leningrad, 1969, 103-123. Translated from the Russian by Robert M. Howland.

The species composition of saprolegnial fungi isolated from fish and spawn was studied at a number of farms of the Leningrad District. Specific methods of collection and culturing of saprolegnial fungi were employed in the work. Fourteen species and one subspecies of saprolegnial fungi of the family Saprolegniaceae, belonging to 5 genera were discovered: Saprolegnia (7 species and 1 subspecies), Achlya (3 species), Dictyuchus (1 species), Aphanomyces (2 species), Thraustotheca (1 species), as well as certain associated species of aquatic and soil fungi. Six species are agents of saprolegniosis of fish in the Leningrad District: of the

g. Saprolegnia - 3, of the g. Achlya - 1, of the g. Dictyuchus - 1, of the g. Aphanomyces - 1. Also examined in the report are separate features of the ecology of the pathogenic species of Saprolegniales; certain peculiarities of the course of the disease in fish are noted.

14952. Horowitz, Jordan J., and Gregory S. Whitt (Dept. of Zool., Univ. of Illinois, Urbana, Illinois 61801). 1972. EVOLUTION OF A NERVOUS SYSTEM SPECIFIC LACTATE DEHYDROGENASE ISOZYME IN FISH. J. Exp. Zool., 180(1): 13-32.

L-lactate dehydrogenase (LDH) exists as tetrameric isozymes in all vertebrates. The polypeptide subunits are encoded in at least two genetic loci, A and B. A third LDH locus, the E locus, is present only in fish. The distinctive E_4 isozyme encoded by this locus is synthesized in the cells of the teleost nervous tissue, particularly in the photoreceptor cells. Electrophoretic and immunochemical procedures were employed to determine which orders of fish have representatives which contain this nervous system specific LDH isozyme. In addition to the 50 species of teleostean and non-teleostean fish examined, a compilation was made of other species reported to contain this enzyme. The LDH E gene function was not detected in Agnathans, Chondrichthyes, Dipnoans, Chondrosteans, and Holosteans. The LDH E gene appears to be restricted to the teleosts. However, some orders of teleosts, e.g., the Cypriniformes, contain many families which lack the E_4 isozyme. The LDH E gene appears to have arisen from a duplication of the LDH B gene near the time of the adaptive radiation of the teleosts. The immunochemical analyses of the LDH isozymes from these fish indicate that the LDH A and B loci of non-teleostean fish have not diverged to the extent as these same loci in teleosts. (Authors)

14953. Wheat, Thomas E., Gregory S. Whitt, and William F. Childers (Cell Biol. Program, Univ. of Ill., Urbana, Illinois 61801). 1972. LINKAGE RELATIONSHIPS BETWEEN THE HOMOLOGOUS MALATE DEHYDROGENASE LOCI IN TELEOSTS. Genetics, 70: 337-340.

The closely related duplicate gene loci encoding the supernatant malate dehydrogenase isozymes of fish are not closely linked. The absence of linkage between these closely related loci may be related to the means of gene duplication and/or the specificity of their regulation.

14954. Mann, H. (Inst. für Küsten - und Binnenfischerei der Bundesforschungsanstalt für Fischerei, Hamburg, Germany). 1971. INVESTIGATIONS ON THE EFFECTS OF WASHING ENZYMES ON FISHES AND OTHER WATER ORGANISMS. (Untersuchungen über die Wirkung von Waschmittel enzymen auf Fische und andere Wasserorganismen). Archiv für Fischereiwissenschaft, 22(2): 146-154. In German with English summary).

Lately proteolytic enzymes have gained significance as components of washing compounds. The fact that detergents get into the draining canal with household sewage led to investigations on the effect of the proteolytic enzyme maxatase P on fish and other water organisms of fresh and brackish water. The most sensitive organisms are fish eggs and larvae. The LD_{50} (24 hours) for eggs of aquarium fish (Rivulus cylindraceus) and trout fry amounts to approx. 1 or 5 mg/l of maxatase P. Fully grown fish can endure relatively higher concentrations. According to research carried out on elver, the detrimental effect of maxatase P examined increases with increasing salinity. Gammarids of brackish water are, according to our investigations, least affected. With heating of the washing solution to more than 50°C during the washing process the greater part of the enzymes is destroyed, and only a small quantity gets into the household wastewater. The remainder will be decomposed in the treatment plants. Therefore, it is considered that under normal conditions proteolytic enzymes of detergents will have no detrimental effect. (Auth. summ.)

14955. FAO of the United Nations (Rome, Italy). 1972. SELECTED TERMS IN FISH CULTURE. FAO Fish Culture Terminology Bulletin No. 19, English-French-Spanish (with Latin for names of fish and fish diseases), 106 p.

14956. Ellis, James E. (NMFS, Fish Farm Experiment Sta., Kelso, Arkansas 71666). 1972. THE USE OF ELECTRICITY IN CONJUNCTION WITH A 12.5-METER (HEADROPE) GULF-OF-MEXICO SHRIMP TRAWL IN LAKE MICHIGAN. U. S. Dept. of Commerce, NOAA Technical Report NMFS SSRF-653, 10 p.

The catching efficiency of a 12.5-meter standard shrimp trawl and the same trawl fitted with three different electrode array systems with power on and power off was investigated. The standard trawl caught 1.54 times or 54.2% more kilograms of fish than the electrode-equipped trawl with power off. The electrode array hanging across the mouth area of the trawl acted as a visual stimulant and thus reduced the trawl's catch rate. Overall the electrical trawl with power on caught 1.19 times or 19.0% more kilograms of fish than the electrical trawl with power off. Array 2 with power on had the best catch rate - 1.86 times or 86.9% more kilograms of fish than the power off catch rate. The avoidance of fish to an electrode array was more than offset with the catch rate of array 2 with power on. The dominance patterns of the catches with each system tested did not change significantly with the exception of chub catches with array 2 with power on. Length selectivity was highly significant for chubs caught with arrays 2 and 3 with power on. No significant length selectivity occurred with the other species landed. (Auth.)

14957. Parker, R. O., Jr. (NMFS, Atlantic Estuarine Fisheries Center, Beaufort, North Carolina 28516). 1972. AN ELECTRONIC DETECTOR SYSTEM FOR RECOVERING INTERNALLY TAGGED MENHADEN, GENUS Brevoortia. U. S. Dept. of Commerce, NOAA Technical Report NMFS SSRF-654, 7 p.

Operation and results are described of an electronic detector-recovery system for fish with internal ferromagnetic tags. The system does not interfere with the operation of fish reduction plants. Date and location of recapture can be obtained since tagged fish are detected and recovered as they are landed. Growth rates of 3.1 and 7.2 mm per month were obtained for two menhaden out 130 and 483 days. Scale analyses supported annulus formation assumption. The best location for tag injection in adult menhaden appears to be about 13 mm above and just forward of the origin of the pelvic fin. Tag incisions were healed in 85% of the fish recaptured after 10 days. (Auth.)

14958. Sutherland, Doyle F. (NMFS, Northwest Fisheries Center, 2725 Montlake Blvd. East, Seattle, Washington 98102). 1972. IMMOBILIZATION OF FINGERLING SALMON AND TROUT BY DECOMPRESSION. U. S. Dept. of Commerce, NOAA Technical Report NMFS SSRF-655, 7 p.

Laboratory experiments revealed that some chinook salmon (Oncorhynchus tshawytscha) and coho salmon (O. kisutch) fingerlings are immobilized when decompressed from atmospheric pressure to high negative pressures. About 69% of the chinook salmon were partially or completely immobilized at 71 cm of mercury vacuum, 48% at 61 cm, 17% at 51 cm, and none at 41 cm. The effects developed rapidly, peaking 5 min after exposure. The coho salmon, in comparison, were less severely affected. Only 9% were immobilized at 71 and 61 cm of mercury vacuum (reached 10 min after exposure), 2% at 51 cm (5 min after exposure), and none at 41 cm. Studies (with coho salmon and rainbow trout [Salmo gairdneri]) to determine the effects of decompression within a turbine of a dam did not provide conclusive results. However, some fingerlings caught in the tailrace immediately after their release in the turbine intake were immobilized. Exposure to negative pressure below turbine runner blades is one possible cause of immobilization. (Auth.)

14959. Shumway, Dean L., and George G. Chadwick (Dept. of Fish. & Wildl., Oregon State Univ., Corvallis, Oregon). 1971. INFLUENCE OF KRAFT MILL EFFLUENT ON THE FLAVOR OF SALMON FLESH. Water Research, 5(11): 997-1003.

In a laboratory study measurable impairment of the flavor of cooked flesh of jack coho salmon resulted from exposure of the fish to untreated kraft pulp and paper mill effluents for 72 to 96 h at concentrations of about 1.0 to 2.0 percent by volume and above. No flavor impairment was noted when fish were exposed to a concentration of 2.9 percent by volume, the highest level tested, of biologically treated effluent. (Authors)

14960. Lind, O. T. 1971. THE ORGANIC MATTER BUDGET OF A CENTRAL TEXAS RESERVOIR. In: Gordon E. Hall (Ed.) Reservoir Fisheries and Limnology. Special Publ. No. 8. Amer. Fish. Soc., Washington, pp. 193-202.

The annual gain of organic matter by a 7500 acre reservoir was 170×10^9 kilocalories. Allochthonous input from four tributaries was 50×10^9 kilocalories. Autochthonous primary production was 168×10^9 kilocalories. Discharges lost 48×10^9 kilocalories. Reservoir construction on the stream system had little influence on quantity of organics being received downstream since tributary input and discharge output were approximately equal; however, the form was considerably changed with soluble organics making up a larger proportion of the discharge. The reservoir also assured organic-dependent communities downstream a more constant supply without the marked seasonal fluctuations of organic transport typical of unimpounded streams. (Auth.)

14961. Schnick, Rosalie A. (Bur. of Sport Fish. & Wildl., Fish Control Lab., La Crosse, Wisconsin). 1972. A REVIEW OF LITERATURE ON TFM (3-TRIFLUORMETHYL-4-NITROPHENOL) AS A LAMPREY LARVICIDE. U. S. Dept. of the Interior, Bur. of Sport Fish. & Wildl. Investigations in Fish Control No. 44, 31 p.

The search for a selective toxicant to control the sea lamprey, scourge of Great Lakes fisheries, culminated in the discovery of TFM (3-trifluormethyl-4-nitrophenol) in the late 1950's. The research, however, had only begun on its chemical and physical properties, efficacy, toxicity to non-target and target species, residues and methods. Federal, State, university, and industrial agencies contributed much in the effort to determine the effect of TFM on the environment and other organisms; however, much still remains to be done if TFM is to gain continued clearance by the Environmental Protection Agency for use as a larval lampricide in the aquatic environment. (Auth.)

14962. Hilsenhoff, William L., Jerry L. Longridge, Richard P. Narf, Kenneth J. Tennessen, and Craig P. Walton. 1972. AQUATIC INSECTS OF THE PINE-POPPLE RIVER, WISCONSIN. Dept. of Natural Resources, Madison, Wisconsin Technical Bulletin No. 54, 44 p., illus.

Collections were made from May 1967 through August 1969 on the Pine River, Popple River and Woods Creek in Florence and Forest Counties to document the aquatic insect fauna of these wild rivers. Distribution and abundance were recorded, and notes summarized on the ecology, life cycles and identification of: Plecoptera (34 species), Ephemeroptera (approximately 60 species), Odonata (39 species), Trichoptera (149 species), Megaloptera (3 species), aquatic and semi-aquatic Hemiptera (47 species), aquatic Coleoptera (54 species), and aquatic Diptera (43 genera). (Authors)

14963. Sonstegard, R. A., L. A. McDermott, and Karen S. Sonstegard (Dept. of Microbiol., College of Biol. Science, Univ. of Guelph, Guelph, Ontario, Canada). 1972. ISOLATION OF INFECTIOUS PANCREATIC NECROSIS VIRUS FROM WHITE SUCKERS (Catastomus commersoni). Nature, 236(5343): 174-175.

A virus survey was conducted to determine the possible presence of IPN virus in fishes in the tailwaters of two IPN-infected trout hatcheries. Only one isolation of virus was made from all the fishes examined. This came from one visceral homogenate prepared from ten yearling white suckers (Catastomus commersoni). This is the first report of the isolation of IPN virus from non-salmonid fishes. The visceral homogenate from the suckers had an IPN titer of $10^{3.1}$ $TCID_{50}$; however, this does not necessarily prove active infection with IPN. This finding suggests that white suckers and perhaps other non-salmonids may play a role in the ecology and epizootiology of IPN.

14964. Akhmerov, A. Kh., and E. A. Bogdanova (Lab. of Fish Diseases of VNIORKH). 1955. A METHOD OF PREPARING MICROSCOPICAL PREPARATIONS OF Trichodina FROM PRESERVED FISH. (Sposob Prigotovleniya Mikroskopicheskikh Preparatov Trichodina iz Fiksirovannykh ryb). Zoologicheskiĭ Zhurnal, 34(1): 234-235. Translated from the Russian by Robert M. Howland.

14965. Faktorovich, K. A. 1969. HISTOLOGICAL CHANGES IN THE LIVER, KIDNEYS, SKIN AND BRAIN OF FISH SICK WITH RED ROT. (Gistologicheskie Izmeneniya v Pecheni Pochkakh, Kozhe i Golovnom Mozgu Bol'nykh Krasnukhoi ryb). Infectious Diseases of Fish and their Control (Infektsionnye bolezni ryb i Bor'ba s Nimi). Izvestiya Gosudarstvennogo Nauchno-Issledovatel'skogo Instituta Ozernogo i Rechnogo Rybnogo Khozyaĭstva, Ministerstvo Rybnogo Khozyaĭstva RSFSR, Vol. 69, 83-101. (Translated from the Russian by Robert M. Howland).

With the help of histological methods, the liver, kidneys, skin and brain of healthy fish and fish sick with red rot were investigated. It was established that the changes observed in the liver, kidneys and skin of sick carp, -wild carp and -crucian carp are non-specific and vary extremely depending on the form of the disease. They cannot serve as any reliable diagnostic symptoms. In carp, wild carp, crucian carp and white amurs, sick with the acute form of red rot, in 100% of the cases eosinophilic cytoplasmic inclusions are discovered in the cells of the isthmal ganglion of the brain. Such inclusions are found in some of the individuals sick with the chronic form of red rot, and in some of the outwardly healthy fish of the stock infected with red rot. In healthy fish from farms where red rot is absent, eosinophilic inclusions could not be detected in the isthmal ganglion of the brain. It is proposed to utilize the eosinophilic cytoplasmic inclusions in the brain of sick fish for the diagnosis of red rot.

14966. Vladimirov, V. L. 1969. ON SOME FACTORS OF IMMUNITY IN FISH (O Nekotorykh Faktorakh Immuniteta u ryb) Infectious Fish Diseases and their Control (Infektsionnye Bolezni Ryb i Bor'ba s Nimi). Izvestiya Gosudarstvennogo Nauchno-Issledovatel'skogo Instituta Ozernogo i Rechnogo Rybnogo Khozyaĭstva, Vol. 69, Ministerstvo Rybnogo Khozyaĭstva RSFSR, Leningrad, 173-181. Translated from the Russian by Robert M. Howland.

The complement activity, and also the titers of the amboceptor and the lysozyme of the blood sera of the carp, roach, trout, pikeperch, whitefish and burbot were studied. They proved to be relatively low. A dependence of lysozyme activity on season and especially on the intensity of antibody synthesis in the carp and the trout in relation to the type of vaccine and temperature conditions was determined.

14967. Mosser, Jerry L., Nicholas S. Fisher, and Charles F. Wurster (Marine Sci. Res. Center, State Univ. of New York, Stony Brook, New York). 1972. POLYCHLORINATED BIPHENYLS AND DDT ALTER SPECIES COMPOSITION IN MIXED CULTURES OF ALGAE. Science, 176(4034): 533-535.

Either DDT or polychlorinated biphenyls were added to mixed cultures containing a marine diatom and a marine green alga that were sensitive and resistant, respectively, to these organochlorine compounds. The diatom grew faster and was therefore dominant in control cultures, but its dominance diminished in treated cultures, even at concentrations of chlorinated hydrocarbons that had no apparent effect in pure cultures. Such stable pollutants could disrupt the species composition of phytoplankton communities, thereby affecting whole ecosystems. (Authors)

14968. Koivo, A. J., and G. R. Phillips (School of Electrical Engineering, Purdue Univ., Lafayette, Indiana). 1972. ON DETERMINATION OF BOD AND PARAMETERS IN POLLUTED STREAM MODELS FROM DO MEASUREMENTS ONLY. Water Resources Research, 8(2): 478-486.

The biochemical oxygen demand (BOD) concentration, the BOD removal coefficient, and the average daily photosynthesis minus respiration term of a polluted stream model can be determined by using only measurements of the dissolved oxygen (DO) concentration taken at discrete locations and the values of the remaining parameters. The mathematical model used is a modified Streeter-Phelps relationship describing the average daily DO and BOD concentrations for a polluted stream under steady state conditions. The procedure provides a least squares fit to the DO measurements and is illustrated by pertinent numerical examples. (Authors)

14969. Brett, J. R., J. R. Calaprice, R. J. Ghelardi, W. A. Kennedy, D. B. Quayle, and C. T. Shoop (Fish. Res. Bd. of Canada, Pacif. Biol. Sta., Nanaimo, British Columbia, Canada). 1972. A BRIEF ON MARICULTURE. Fish. Res. Bd. Canada Technical Report No. 301, 46 p.

14970. Chittenden, Mark E., Jr. (Dept. of Environ. Sci., Rutgers, The State Univ., New Brunswick, New Jersey). 1971. EFFECTS OF HANDLING AND SALINITY ON OXYGEN REQUIREMENTS OF THE STRIPED BASS, Morone saxatilis. J. Fish. Res. Bd. Canada 28(12): 1823-1830.

Oxygen requirements of striped bass, Morone saxatilis, were studied at 0 and 10 °/oo salinity using combinations of handling and constantly decreasing oxygen concentrations. Effects of handling and salinity on oxygen requirements were negligible or absent. Successive and merging patterns of behavior at low oxygen concentrations were: restlessness, spasmodic swimming, surfacing, inactivity, equilibrium loss, and death. Mean oxygen levels with 99% confidence limits at restlessness, inactivity, equilibrium loss, and death were $1.81 \pm .10$, $1.28 \pm .10$, $0.95 \pm .06$, and $0.72 \pm .04$ mg/liter. Virtually no fish exhibited these behavior patterns until oxygen declined to 3.12, 2.19, 1.44, and 1.04 mg/liter, respectively; nearly all fish did at 0.91, 0.66, 0.62, and 0.50 mg/liter, respectively. Size of fish did not affect oxygen levels at death and equilibrium loss. Ventilation rate was maximum at 2.0-3.0 mg/liter and declined at lower concentrations. Amplitude was maximum at the beginning of inactivity then declined. Because short-term respiratory failure occurred at equilibrium loss, this behavior probably represents oxygen levels that would cause an abrupt fish-kill. Long-term respiratory failure at inactivity indicated that death would follow a period of resistance. There is no sharp distinction between suitable and unsuitable oxygen concentrations, because duration of exposure determines the intensity of the result even at lethal levels. Onset of restlessness (about 3 mg/liter at 16-19 C) probably represents the minimum permissible oxygen level for normal existence. Even this may be insufficient to maintain optimum populations of striped bass. (Auth.)

14971. Jonas, R. E. E. (Fish. Res. Bd. of Canada, Vancouver Lab., Vancouver, British Columbia, Canada). 1971. THE SOLUBILIZING EFFECT OF LYSOLECITHIN ON THE EXTRACTABILITY OF VARIOUS TISSUES OF RAINBOW TROUT (Salmo gairdneri). J. Fish. Res. Bd. Canada, 28(12): 1837-1840.

Liver homogenate treated with and without lysolecithin (LL) and centrifuged at 1600 g and the supernatant portion centrifuged again at 20,000 g showed disintegration of organelles with disruption of their membranes in the pellet fractions of that which was treated with LL, whereas the organelles of the others were normal. This was seen from the electron micrographs of the pellet fractions. The amino acid composition of the protein fraction of the white skeletal muscle soluble in 0.9% NaCl and of the larger fraction extractable in 0.9% NaCl with LL added were similar. The total nitrogen found in the supernatant fraction of brain, kidney, and liver homogenates reached approximately 44, 59, and 63% in 0.9% NaCl and $\approx$ 88, 95, and 89% in 0.9% NaCl containing 4 mg/ml LL; whereas the total N present in heart muscle and white muscle homogenates reached approximately 39 and 31% in 0.9% NaCl and $\approx$ 61 and 51% in 0.9% NaCl containing 4 mg/ml LL. LL destroyed the ability of liver tissue and liver mitochondria to oxidize ^{14}C palmitate. It was concluded that the effect of LL in increasing the amount of protein extractable from fish tissue homogenates arises from its ability to lower surface tension and disrupt membranes and not by affecting protein solubility. (Auth.)

14972. Arthur, John W., and John G. Eaton (U. S. Environ. Protection Agency, Nat. Water Qual. Lab., Duluth, Minnesota 55804). 1971. CHLORAMINE TOXICITY TO THE AMPHIPOD Gammarus pseudolimnaeus AND THE FATHEAD MINNOW (Pimephales promelas). J. Fish. Res. Bd. Canada, 28(12): 1841-1845.

The amphipod Gammarus pseudolimnaeus was subjected to 96-hr and 15-week exposures, and the fathead minnow (Pimephales promelas) to a 21-week exposure, to various chloramine concentrations under continuous-flow conditions. The most marked sublethal effects were reductions in the number of young produced by the amphipod and in egg production by the minnow. The 96-hr median tolerance limit for the amphipod was 220 µg/liter total chloramine. Fathead minnows in the long-term study were all killed at the highest concentration, 154 µg/liter total chloramine, within 3 days. The lowest measured total chloramine concentration in the long-term tests having no significant effect was $<$ 3.4 µg/liter for the amphipod and 16.5 µg/liter for the fathead minnow. (Authors)

14973. Ware, D. M. (Inst. of Resource Ecology, The Univ. of Brit. Columbia, Vancouver, British Columbia, Canada). 1971. PREDATION BY RAINBOW TROUT (Salmo gairdneri): THE EFFECT OF EXPERIENCE. J. Fish. Res. Bd. Canada, 28(12): 1847-1852.

Rainbow trout (Salmo gairdneri) provided with unfamiliar palatable food changed several components of their feeding behaviour and demonstrated that they can develop searching images for specific prey. Naive fish required an average of 4 days of experience, each of which consisted of exposure to six food particles, before they approached novel prey. After this time the distance from which trout attacked food improved and had doubled by the 12th day of exposure. When conditioned animals were deprived of experience for 90 days, the distance of reaction fell back to the initial naive level. The relation of these results to current work on searching image formation is discussed. (Auth.)

14974. Markert, J. R., and W. E. Vanstone (Fish. Res. Bd. of Canada, Vancouver Lab., Vancouver 8, British Columbia, Canada). 1971. EGG PROTEINS OF COHO SALMON (Oncorhynchus kisutch): CHROMATOGRAPHIC SEPARATION AND MOLECULAR WEIGHTS OF THE MAJOR PROTEINS IN THE HIGH DENSITY FRACTION AND THEIR PRESENCE IN SALMON PLASMA. J. Fish. Res. Bd. Canada, 28(12): 1853-1856.

The molecular weights of the three major proteins in the soluble fraction of coho salmon (Oncorhynchus kisutch) eggs were found to be: lipovitellin, 390,000; β'-component, 30,000; and phosvitin, 27,000. Immunological techniques showed that these proteins were present in the plasma of sexually maturing female coho and of estrogenized prepuberal coho of both sexes but not of sexually maturing males or nonestrogenized prepuberal coho. These findings support the previous postulation that the β'-component should be classified not as a livetin but as an egg protein, as are lipovitellin and phosvitin. (Authors)

14975. Collins, John J. (Res. Branch, Ont. Dept. of Lands and Forests, South Baymouth, Ontario, Canada). 1971. INTRODUCTION OF KOKANEE SALMON (Oncorhynchus nerka) INTO LAKE HURON. J. Fish. Res. Bd. Canada, 28(12): 1857-1871.

An experimental introduction of kokanee salmon (Oncorhynchus nerka) into Lake Huron from egg stocks obtained from British Columbia and several western states of the United States began in 1964. From 1964 to 1969, about 5.5 million kokanee (eggs, fry, and fingerlings) were planted. Estimated minimum returns of adults were 9000, 1200, and 4000 in 1967, 1968, and 1969, respectively. Although most of the returns were recorded near planting sites, substantial numbers moved into other areas, in some instances spawning in streams that were not planted. Apparently, most kokanee matured in their 3rd year of life (2+) and their lengths ranged from 18 to 49 cm. The incidence of lamprey marks on adults was light (1.6% of 4472 examined) but frequencies of marks tended to increase as fish size increased - from 0.5% for 28-32 cm fish to 16.7% for fish over 40 cm long. Successful stream spawning in 1967 was indicated by the retrieval of live eggs and alevins from redds and the capture of downstream migrant fry. Shore spawning was verified by retrieval of viable eggs from redds in 1969. The potential egg deposition in the two rivers with the largest runs in 1967 was approximately 2.7 million eggs. Fish from British Columbia river-spawning stock spawned both in streams and along shores of South Bay. Since spawning was not restricted to streams, the shore areas of Lake Huron may extend the spawning habitat available to kokanee. Adult kokanee fed mainly on insects and plankton during August and September. Aerial forms of insects predominated in South Bay kokanee. Dieldrin and DDT residues were moderate, averaging between 0.012 and 0.046 ppm for dieldrin and 0.226 and 1.242 ppm for DDT in whole tissue samples. Data from South Bay show that the principal species found in association with kokanee were alewife and smelt. The diet of alewife in August indicated possible competition with kokanee. (Auth.)

14976. Dimond, J. B., A. S. Getchell, and J. A. Blease (Depts. of Entomology and Biochem., Univ. of Maine, Orono, Maine 04473). 1971. ACCUMULATION AND PERSISTENCE OF DDT IN A LOTIC ECOSYSTEM. J. Fish. Res. Bd. Canada, 28(12): 1877-1882.

DDT persisted in streams of several small watersheds in Maine for at least 10 years following light applications to the forest. Residues declined sharply within 2 or 3 years after application, but after 10 years were still well above concentrations detected in untreated streams. This was true of all components studied: muds, plants, invertebrates, fish, and fish-eating birds. The prolonged persistence led to cumulative residue levels in streams sprayed more than once. Concentration of residues through the food chain was evident. (Authors)

14977. Harvey, H. H., and J. F. Coombs (Dept. of Zool., Univ. of Toronto, Toronto, Ontario, Canada). 1971. PHYSICAL AND CHEMICAL LIMNOLOGY OF THE LAKES OF MANITOULIN ISLAND. J. Fish. Res. Bd. Canada, 28(12): 1883-1897.

Of 51 of the large lakes on Manitoulin Island investigated from 1965 to 1970, 10 were found to be dimictic and 41 polymictic, most of the latter being very shallow. Twenty of the polymictic lakes evidenced one or more trenches in the lake bottom. These trenches may be maintained by wind-induced water currents. In one such trenched lake, Smoky Hollow Lake, winter oxygen declined to less than 1 ppm before surface melt-water entered the lake under the ice sheet. Winter kills of fish such as yellow perch (Perca flavescens) and northern pike (Esox lucius) were observed in three lakes, but the presence of older age-classes of fish in most lakes suggested that extensive winter kills are not common. The survival of fishes in the many shallow lakes is made possible by the continued presence of at least a small amount of oxygen in winter and the timely arrival of surface melt-water under the ice sheet. Most of the lakes had a high pH (7.9-9.1) and were rich in magnesium (mean 17.9 ppm) in relation to calcium (34.2 ppm), consistent with the underlying dolomitic bedrock. Sodium (mean 1.5 ppm) and potassium (0.8 ppm) were present at unusually low concentrations. (Authors)

14978. Wedemeyer, Gary (U. S. Bur. of Sport Fish. & Wildl., Western Fish Disease Lab., Bldg. 204, Sand Point N.S.A., Seattle, Washington 98115). 1971. THE STRESS OF FORMALIN TREATMENTS IN RAINBOW TROUT (Salmo gairdneri) AND COHO SALMON (Oncorhynchus kisutch). J. Fish. Res. Bd. Canada, 28(12): 1899-1904.

Changes in gill function, acid-base balance and pituitary activation occurring during standard 200 ppm formalin treatments of juvenile rainbow trout (Salmo gairdneri) and coho salmon (Oncorhynchus kisutch) were compared. Plasma Cl^-, Ca^{++}, total CO_2, and interrenal vitamin C in the trout declined continuously and in proportion to the exposure time, but the salmon were able to maintain these metabolic parameters at approximately initial levels. Blood pH and alkaline reserve regulation of the salmon was also less affected by formalin treatments, especially during prolonged exposures. The oxygen consumption of both species was depressed, but substantially more so in the trout than could be accounted for by decreased ventilation rates. Little frank hemolysis occurred in either species, but there was a significant bilirubinemia in the trout. (Auth.)

14979. Ott, A. G., and H. F. Horton (Dept. of Fish. and Wildl., Oregon State Univ., Corvallis, Oregon). 1971. FERTILIZATION OF STEELHEAD TROUT (Salmo gairdneri) EGGS WITH CRYO-PRESERVED SPERM. J. Fish. Res. Bd. Canada, 28(12): 1915-1918.

The average percent fertilization of fresh steelhead trout (Salmo gairdneri) ova inseminated with cryo-preserved sperm was 59 in 90 tests. Sodium bicarbonate, lecithin, and mannitol at 750, 750, and 250 mg/100 ml, respectively, were included in the extender. The most effective concentration of dimethyl sulfoxide in the extender was 12% (v/v). Significant differences in percent of fresh ova fertilized with cryo-preserved sperm were attributed to both parents. (Authors)

14980. Voyer, R. A., and G. E. Morrison (Nat. Marine Water Qual. Lab., West Kingston, Rhode Island). 1971. FACTORS AFFECTING RESPIRATION RATES OF WINTER FLOUNDER (Pseudopleuronectes americanus). J. Fish. Res. Bd. Canada, 28(12): 1907-1911.

In one series of experiments, average rates of oxygen consumed by winter flounder at 10 C were 35 and 55 mg O_2/kg of body weight per hour at 3.5 and 8.6 mg dissolved oxygen (DO)/liter, respectively. At 20 C the average rates of oxygen uptake were 70 at 3.2 mg DO/liter and 97 at 6.3 mg DO/liter. Oxygen consumption rates were significantly greater ($P < .05$) at 20 C than at 10 C. In two of the three experiments, rates of oxygen uptake were significantly lower ($P < .05$) among groups of winter flounder maintained at the reduced dissolved oxygen concentrations for 15-23 hr. No dissolved oxygen-temperature interactions were apparent. Results of a second series of experiments indicated respiration rates of winter flounder increased linearly with weight along regression lines having slopes of 0.792 (20 C - 6.9 mg DO/liter), 0.785 (20 C - 4.3 mg DO/liter), 0.720 (10 C - 8.7 mg DO/liter), and 0.746 (10 C - 4.3 mg DO/liter). (Authors)

14981. Aulstad, D., and A. Kittelsen (The Agric. Coll. of Norway, Inst. of Animal Genetics and Breeding, Vollebekk, Norway). 1971. ABNORMAL BODY CURVATURES OF RAINBOW TROUT (Salmo gairdneri) INBRED FRY. J. Fish. Res. Bd. Canada, 28(12): 1918-1920.

In an inbreeding experiment with rainbow trout (Salmo gairdneri), a special type of deformed fry was found. The deformity appeared after one generation of fullsib mating in one of nine fullsib groups. The deformed fry were observed soon after the resorption of the yolk sac and showed different forms of body curvatures. The deformity was lethal. Significant differences between inbred groups and the noninbred control groups indicate that the deformity is at least partly heritable. (Authors)

14982. Ito, Jun, and R. R. Parker (Fish. Res. Bd. of Canada, Biol. Sta., Nanaimo, British Columbia, Canada). 1971. A RECORD OF PACIFIC HERRING (Clupea harengus pallasi) FEEDING ON JUVENILE CHINOOK SALMON (Oncorhynchus tshawytscha) IN A BRITISH COLUMBIA ESTUARY. J. Fish. Res. Bd. Canada, 28(12): 1921.

An occurrence of Pacific herring (Clupea harengus pallasi) predation on juvenile chinook salmon (Oncorhynchus tshawytscha) is described. This is the first recorded incidence of this particular predator-prey relation. (Authors)

14983. Mather, Frank J., III, Albert C. Jones, and Grant L. Beardsley, Jr. (Woods Hole Oceanographic Institution, Woods Hole, Massachusetts 02543). 1972. MIGRATION AND DISTRIBUTION OF WHITE MARLIN AND BLUE MARLIN IN THE ATLANTIC OCEAN. U. S. Dept. of Commerce, NOAA Fishery Bull., 70(2): 283-298.

Migration and distribution of white marlin, Tetrapturus albidus Poey, and blue marlin, Makaira nigricans Lacépède, in the Atlantic Ocean are discussed on the basis of tagging data (western North Atlantic, 1954-May 1970) and statistics of the Japanese Atlantic longline fishery (1956-67). White and blue marlins are widely distributed over the warmer waters of the Atlantic. Seasonal concentrations occur in certain areas, especially in the western Atlantic. In the North Atlantic one group of white marlin summers off the U. S. middle Atlantic coast. In the fall fish of this group migrate offshore, then south to winter off the north coast of South America. In the spring these fish return north along or through the Antilles and the Bahamas. Tagged fish from this group were recaptured after up to 4 years at liberty; the returns suggest that the annual mortality is between 14% and 39%. There are apparently other groups of white marlin in the North Atlantic that move seasonally between various localities, but these movements have not been fully defined. An apparently separate population of white marlin concentrates in the eastern South Atlantic Ocean in winter and in the western part in summer. Blue marlin concentrate in the Caribbean Sea, the Gulf of Mexico and the North Atlantic south of lat 30°N, from June through October, and in the western and central South Atlantic between lat 10° and lat 20°S from February through April. These concentrations probably represent distinct spawning populations. (Authors)

14984. Graham, Joseph J. (NMFS, Northeast Fisheries Center, Boothbay Lab., W. Boothbay Harbor, Maine 04575). 1972. RETENTION OF LARVAL HERRING WITHIN THE SHEEPSCOT ESTUARY OF MAINE. U. S. Dept. of Commerce, NOAA Fishery Bull., 70(2): 299-305.

This paper demonstrates a system of larval movements that retains larval herring within an estuary despite its seaward residual flow. Data are reviewed from a 2^3 factorial design using buoyed and anchored nets in a narrow channel of the estuary. Three factors were involved: location, tidal phase, and depth. Catch rates of larvae relative to these factors suggested that the larvae maintained their position in the upper portion of the estuary by (1) occupying the landward net tidal flow near the bottom, (2) moving upward upon reaching the limit of their landward penetration (3) then seaward in the net flow near the surface, and (4) finally descending again into the landward net flow. (Auth.)

14985. Graham, Joseph J., Stanley B. Chenoweth, and Clarence W. Davis (NMFS Northeast Fisheries Center, Boothbay Lab., W. Boothbay Harbor, Maine 04575). 1972. ABUNDANCE, DISTRIBUTION, MOVEMENTS, AND LENGTHS OF LARVAL HERRING ALONG THE WESTERN COAST OF THE GULF OF MAINE. U. S. Department of Commerce, NOAA Fishery Bull., 70(2): 307-321.

This paper describes the abundance, distribution, movements, and lengths of larval herring along the western coast of the Gulf of Maine. Larvae were most numerous in the catches throughout the coast in the autumn, reached a low in the winter, and increased in the spring. Growth in the autumn is estimated at 1 to 1.3 mm per 5-day intervals. Larval mortality was highest in the autumn, lower in the winter, and lowest in the spring. The mortality in the winter usually varied with their condition and determined the subsequent level of spring abundance. We selected three different types of estimates as desirable for predicting the recruitment of immature herring to the sardine fishery of Maine: (1) winter mortality, (2) larval condition in the winter, and (3) spring abundance. (Authors)

14986. Dahlberg, Michael D. (Univ. of Ga., Marine Inst., Sapelo Island, Georgia 31327). 1972. AN ECOLOGICAL STUDY OF GEORGIA COASTAL FISHES. U. S. Dept. of Commerce, NOAA Fishery Bull., 70(2): 323-353.

The distribution of fishes in relation to ecological factors was studied in a Georgia estuary and adjoining beach and coastal plain creek waters to establish fundamental base lines for the ecology of a relatively undisturbed section of the coast. The distributions of 168 fish species were related to nine recognizable habitats, temperature, and salinity. Length frequencies and spawning seasons were determined for most of the trawled species that contributed significantly to fish production in the estuary. Collecting by a variety of techniques permitted evaluations of types of life cycles, of diversity in the various aquatic habitats, and of distribution patterns within the estuarine complex and adjoining waters. Numbers of species collected in nine aquatic habitats were as follows: beach - 114, lower reach of the estuary - 100, high marsh - 56, upper and middle reaches - 61, oligohaline creek - 40, fresh water - 39, tidal canal - 22, low-salinity tidal pool - 22, high-salinity tidal pool - 37. (Auth.)

14987. Johnson, Allyn G., Fred M. Utter, and Harold O. Hodgins (NMFS, Northwest Fisheries Center, Seattle Lab., 2725 Montlake Blvd. East, Seattle, Washington 98102). 1972. ELECTROPHORETIC INVESTIGATION OF THE FAMILY SCORPAENIDAE. U. S. Dept. of Commerce, NOAA Fishery Bull. 70(2): 403-413.

Thirty-one species of three genera of the family Scorpaenidae were separated into 17 groups based on starch gel electrophoretic comparison of muscle proteins and six enzymatic systems. This study concluded that relatively greater similarity existed between the Pacific Sebastes and the Atlantic Sebastes than between either and the other genera. Ten of the 27 species of Pacific Sebastes tested had unique biochemical profiles which may be useful for identification of specimens. (Authors)

14988. Hoag, Stephen H. (Fish. Research Inst., Univ. of Washington, Seattle, Washington 98195). 1972. THE RELATIONSHIP BETWEEN THE SUMMER FOOD OF JUVENILE SOCKEYE SALMON, Oncorhynchus nerka, AND THE STANDING STOCK OF ZOOPLANKTON IN ILIAMNA LAKE, ALASKA. U. S. Dept. of Comm., NOAA Fishery Bull., 70(2): 355-362.

The foregut contents of juvenile sockeye salmon in samples taken at night by tow net in the limnetic area of Iliamna Lake consisted primarily of zooplankton and rarely of insects. The number of organisms per foregut was correlated with the estimated zooplankton density between 0 and 100 m. Cyclops and Bosmina were the dominant zooplankters in both foregut and zooplankton samples. The zooplankton hauls contained a greater percentage of calanoid copepods than the fish foreguts. Food selectivity was indicated but appeared to be minimal. Fry (age 0) foreguts contained a lesser percentage of Cyclops and a greater percentage of Bosmina than did yearling (age I) foreguts. (Auth.)

14989. Saila, Saul B., and James D. Parrish (Graduate School of Oceanography, Univ. of R. I., Kingston, Rhode Island 02881). 1972. EXPLOITATION EFFECTS UPON INTERSPECIFIC RELATIONSHIPS IN MARINE ECOSYSTEMS. U. S. Dept. of Comm., NOAA Fishery Bull., 70(2): 383-393.

Due to man's continuing efforts to extract greater harvests of marine organisms from the world ocean, it is becoming increasingly important to be able to predict the consequences of exploitation on complex assemblages of organisms. These assemblages, or ecosystems, consist of predator and prey organisms in various interacting combinations. Preliminary evidence available from studies of marine invertebrate communities in coastal areas has indicated that removal of grazing herbivores or predators at various levels results in lower species diversity and greater instability of the ecosystem. In order to permit a quantitative evaluation of the effects of various rates and types of exploitation on interspecific relationships, model ecosystems were constructed utilizing a subset of graph theory as applied to network analysis. A basic ecological trophic unit was formulated, and these units were combined to form more complex model ecosystems. In particular, a hypothetical four species system of interacting predator and prey organisms was analyzed to demonstrate the consequences of varying certain model coefficients, especially rates of exploitation. It was shown that nonselective exploitation tended to maintain stability of the system better than highly selective exploitation. A hypothetical example of an empirical approach for examining changes in community structure was also demonstrated. (Authors)

14990. McCarthy, James J., and Terry E. Whitledge (Scripps Inst. of Oceanog., La Jolla, California 92037). 1972. NITROGEN EXCRETION BY ANCHOVY (Engraulis mordax AND E. ringens) AND JACK MACKEREL (Trachurus symmetricus). U. S. Dept. of Comm. Fishery Bull., 70(2): 395-401.

Teleost fish have been shown to excrete a variety of nitrogenous substances among which are ammonia, urea, and creatine. Previous reports show values for excretion of near-shore or bottom fish but not of pelagic species. Two species of anchovy and jack mackerel were placed in chambers and their nitrogenous excretion products were measured. Ammonia, urea, and creatine accounted for 82% of the total nitrogen excreted by Engraulis mordax and the identified fraction was 83% ammonia, 16% urea, and 1% creatine. The significance of pelagic fish as a source of ammonia and urea in California coastal waters is discussed. (Authors)

14991. Henry, Kenneth A. (NMFS Northwest Fisheries Center, 2725 Montlake Blvd. East, Seattle, Washington 98102). 1972. OCEAN DISTRIBUTION, GROWTH, AND EFFECTS OF THE TROLL FISHERY ON YIELD OF FALL CHINOOK SALMON FROM COLUMBIA RIVER HATCHERIES. U. S. Dept. of Comm., NOAA Fishery Bull., 70(2): 431-445.

Data are presented depicting the distribution of some stocks of Columbia River hatchery fall chinook salmon in the northeast Pacific Ocean. These are based on recoveries of marked fish. Also presented are the apparent growth histories for fish from the Kalama and Spring Creek Hatcheries as well as a

graphic population model for Columbia River fall chinook salmon. Finally, the effect on total yield for varying troll fishing mortalities for the 3-, 4-, and 5-year old fish is analyzed and the results depicted in three-dimensional yield diagrams. In most instances, at least at the lower levels of estimated natural mortality, troll fishing of the younger fish reduced total yield. (Auth.)

14992. Hoopes, David T. (NMFS, Auke Bay Fisheries Lab., Auke Bay, Alaska 99821). 1972. SELECTION OF SPAWNING SITES BY SOCKEYE SALMON IN SMALL STREAMS. U. S. Dept. of Comm., NOAA Fishery Bull., 70(2): 447-458.

This study was undertaken in three small western Alaska streams to identify factors that influence selection of spawning sites by sockeye salmon. Temporal and spatial distribution patterns were relatively constant from year to year despite large fluctuations in the number of spawners. The selection of a spawning site was more closely related to composition of the stream bottom than to gradient, water depth and velocity, or cover. (Auth.)

14993. Booth, Douglas E. (Fish. Research Inst., 260 Fisheries Center, Univ. of Washington, Seattle, Washington 98195). 1972. A MODEL FOR OPTIMAL SALMON MANAGEMENT. U. S. Dept. of Comm., NOAA Fishery Bull., 70(2): 497-506.

Considerable attention has been given in the literature recently to continuous time dynamic maximizing models for fisheries in general, but the time discreteness and interdependency problems encountered in the case of most salmon fisheries have been largely ignored. Hence, a discrete time profit maximizing model for a salmon fishery is developed in this paper, and it is shown that a correct salmon management policy takes the form of an investment decision with respect to the level of escapement and that a management policy of maximum sustained yield may be incorrect from an economic standpoint. It is hoped that continued research including construction of a working model will provide some indication of the difference between the magnitude of spawner stocks selected on the basis of maximum sustained yield and stocks selected on the basis of economic optimality. (Auth.)

14994. Rothschild, B. J., and D. S. Robson (NMFS Northwest Fisheries Center, 2725 Montlake Blvd. East, Seattle, Washington 98102). 1972. THE USE OF CONCENTRATION INDICES IN FISHERIES. U. S. Dept. of Comm., NOAA Fishery Bull., 70(2): 511-514.

In this report the relationship between two organisms in space or time is considered; in particular, between a predator (a fishing fleet) and a prey (the population to be harvested).

14995. Carlson, Frank T., and John W. Reintjes (NMFS Atlantic Estuarine Fisheries Center, Beaufort, North Carolina 28516). 1972. SUITABILITY OF INTERNAL TAGS FOR ATLANTIC MENHADEN. U. S. Dept. of Comm., NOAA Fishery Bull., 70(2): 514-517.

Atlantic menhaden longer than 115 mm fork length can be tagged internally with a smooth piece of stainless steel and the tags can be recovered on magnets in the reduction plants.

14996. Dandy, J. W. T. (Dept. of Zool., Univ. of Manitoba, Winnipeg, Manitoba, Canada). 1972. ACTIVITY RESPONSE TO CHLORINE IN THE BROOK TROUT, Salvelinus fontinalis (Mitchill). Canad. J. Zool., 50(4): 405-410.

Exposure of brook trout to chlorine evoked changes in activity, ventilation, the "coughing" reflex, and at lethal levels a heavy secretion of mucus. Locomotory activity increased initially and was subsequently depressed. Both responses were seen at 0.35 and 0.08 ppm, but the initial response was not seen at 0.04 or 0.005 ppm. The initial increase lasted 2 h, whilst the depressant response was still continuing after 7 days at the sublethal level of 0.005 ppm. The results are discussed in relation to the different selection responses to different chlorine concentrations shown in rainbow trout by Sprague and Drury (1969). (Auth.)

14997. Bieniarz, Krzysztof, and Ewa Maslowska (Instytul Zoologii Stosowanej WSR Krakow, Al. Michiewicza 24/28, Poland). 1971. INFLUENCE OF LIGHT AND DARKNESS UPON THE BLOOD PICTURE OF CARP (Cyprinus carpio L.). Acta Biologica Cracoviensia, Series: Zoologia, Vol. 19, pp. 267-278.

The influence of light and darkness upon changes of the amount of erythrocytes, haemoglobin, white blood corpuscles, the value of the haematocrit number, and the rate of sedimentation of corpuscles was studied. The value of the albumin-globulin coefficient were investigated, as well as the alterations in the loss of body mass of a two-year carp. Eight series of experiments were carried out lasting from 15 to 38 days during the period November 12, 1965 to March 30, 1966. For each experiment 3 identical glass aquaria were used, each with a capacity of 0.5 m^3. In these aquaria 3 groups of fish, composed of 5 individuals each, remained in three different conditions of light. 1. Conditions of constant light — aquarium illuminated with a single mercury bulb of 250 watts through a glass pane 0.5 cm thick (to eliminate ultra-violet radiation), 2. Control conditions in the daytime — dispersed sunlight, and complete obscurity at night, 3. Conditions of constant and complete darkness — the aquarium totally screened from light. In the course of all the experiments the temperature and the content of oxygen dissolved in the water were controlled. As a result of these experiments no influence of light upon such parameters of the blood as the number of erythrocytes, the percentage of haemoglobin, the relations of morphotic parts of blood to the plasma, the number of white blood corpuscles, the albumin-globulin relation or upon the losses of body mass was observed. It was ascertained, however, that the action of such unfavourable environmental factors as a low oxygen content in the water, in conditions of hunger, provoked a decrease in the number of erythrocytes and in the amount of haemoglobin. (Authors)

14998. Hamoir, G., B. Focant and M. Disteche (Lab. of Gen. Biol., Fac. of Sci., Univ. of Liege, Liege, Belgium). 1972. PROTEINIC CRITERIA OF DIFFERENTIATION OF WHITE, CARDIAC and VARIOUS RED MUSCLES IN CARP. Comp. Biochem. Physiol., 41(4B): 665-674.

Starch-gel electrophoresis shows that cardiac and various red skeletal muscles contain much more myoglobin, a higher amount of hemoglobin and a lower content of glycolytic enzymes than white muscle. The cardiac muscle differs from the red skeletal muscles by its higher content of myoglobin and hemoglobin, its lower content of MM creatine kinase, by the occurrence of MB creatine kinase and by the lack of the slowest LDH isoenzymes as well as of the low molecular weight proteins. The red skeletal muscles can be differentiated by their LDH isoenzyme patterns and their content of muscle low molecular weight proteins. (Authors)

14999. Masic, D., and R. Hamm (Inst. für Chemie und Physik der Bundesanstalt für Fleischforschung, Kulmbach, Germany). 1971. ALANINE AMINOTRANSFERASE IN THE SKELETAL MUSCLE OF THE CARP (Alanin-Aminotransferase in der Skeletmuskulatur des Karpfens). Archiv für Fischereiwissenschaft, 22(3): 200-213. In German with English abstract.

The activity of alanine aminotransferase (glutamic-pyruvic transaminase; GPT) in tissue and press-juice of the skeletal muscle of carp (Cyprinus carpio) was determined. The total GPT activity of the light muscle was fifty times lower than the total GOT activity. Cold-storage (+4°C) and freezing (-20°C) and thawing of tissue did not influence the level of the total GPT activity in the light carp muscle. The GPT activity in the muscle press-juice did not change during storage of the muscle post mortem at +4°C (48 hours); freezing and thawing of carp muscle, however, resulted in an increase of the GPT activity in the muscle press-juice, which might be due to a freeze-damage of muscle mitochondria. The existence of different GPT isozymes could not be demonstrated by electrophoretic methods. (Authors summ.)

15000. Arshanitsa, N. M. 1969. DATA ON THE EPIZOOTOLOGY, DIAGNOSIS AND PROPHYLAXIS OF SWIMBLADDER DISEASE OF THE CARP. (Materialy po epizootologii, diagnostike i profilaktike bolezni plavatel'nogo puzyrya karpa). Infectious Fish Diseases and their Control (Infektsionnye bolezni ryb i bor'ba s nimi). Izvestiya Gosudarstvennogo Nauchno-issledovatel'skogo Instituta Ozernogo i Rechnogo Rybnogo Khozyaĭstva, Vol. 69, Ministerstvo Rybnogo Khozyaĭstva RSFSR, Leningrad, pp. 15-46. Translated by Robert M. Howland.

Data are presented in the report on the epizootology, diagnosis and prophylaxis of swimbladder disease of the carp. It has been determined that this is a mass, independent, infectious disease of carp, wild carp and their hybrids, which is transmitted by direct or indirect contact. The disease is not transmitted in a germinative way. It proceeds both acutely as well as chronically, and also asymptomatically. In recent years it has spread widely in a number of regions of the country as a result of fish transfers. Sick fish acquire relative nonsterile immunity. Epizootological, clinical, pathologo-anatomical and roentgenological methods can be utilized for diagnosis of the disease. Measures for control and prophylaxis include quarantine, estivation of ponds and their disinfection, and the factory method of obtaining carp spawn and larvae. (Auth.)

15001. Lopukhina, A. M. 1969. DATA ON THE ETIOLOGY AND EPIZOOTOLOGY OF GILL DISEASE OF THE CARP. (Materialy po etiologii i epizootologii zhabernogo zabolevaniya karpa). Infectious Fish Diseases and their Control (Infektsionnye bolezni ryb i bor'ba s nimi).Izvestiya Gosudarstvennogo Nauchno-issledovatel'skogo Instituta Ozernogo i Rechnogo Rybnogo Khozyaĭstva, Vol. 69, Ministerstvo Rybnogo Khozyaĭstva RSFSR, Leningrad, pp. 124-137. Translated by Robert M. Howland.

Data concerning study of the gill disease of carp of obscure etiology are set forth in the report. This disease is widespread at the pond farms of the Northwest RSFSR, primarily in fattening ponds among two-summer carp, and partially young-of-the-year and the oldest age groups. It has been recorded in crucian carp also. Outbreaks of gill disease usually occur in summer at the warmest time, but they are possible in winter and spring also. Outwardly, the disease is reminiscent of branchiomycosis, but the fungus Branchiomyces sanguinis has never been discovered in a single case. A parasite of the genus Dermocystidium or close to it is indicated as one of the agents. However, a hypothesis is expressed that the gill disease is mixed, and a question is posed about the necessity for bacteriological and virological investigations for the purpose of establishing a possible secondary agent. (Auth.)

15002. Yamada, Umeyoshi. 1971. VITAL STAINING OF THE HARD TISSUES OF CARP, Cyprinus carpio Linné, WITH TETRACYCLINE-HCl, CALCEIN AND ALIZARIN RED S. Bull. Sekai Fish. Res. Lab., No. 41: 107-116. In Japanese with English abstract.

The time labelling of hard tissues, such as vertebrae and otoliths, of carp Cyprinus carpio, with the injection of three kinds of stain, tetracycline-HCl, calcein and alizarin red S, into the body cavity, was carried out in order to develop a technique of age determination of fish. Through the injection of tetracycline-HCl, calcein and alizarin red S into the living specimens, the process of the formation of hard tissues could easily be traced with time labelling showing the colors of brownish yellow, green and red, respectively. With the combined use of these stains in an appropriate order, the manner of the development of hard tissues, which absorb and affix the stain rapidly, could be observed over a long space of time. The suitable amount for the injection of the three kinds of stain into hard tissues such as vertebrae, otoliths, fin-rays, opercles and pharyngeal teeth was determined as follows: calcein 4-5 mg, tetracycline-HCl 15-20 mg and alizarin red S (excluding otolith) 40-50 mg per 1 kg of body weight of fish. However, for the staining of scales 5 mg of calcein, 60-80 mg of tetracycline-HCl or 150 mg of alizarin red S were necessary respectively. Among the three stains calcein seemed to be the best one, since a small amount,4-5 mg/kg, was enough to stain every hard tissue very distinctly with a thin time label or time mark. Though alizarin red S was effective for vertebrae, fin-rays and opercles it was inefficient to stain

otolith. In general, the width of the time labelling obtained with tetracycline HCl was wider than those formed by calcein and alizarin red S, and it gave a diffusion. This tendency was especially conspicuous in staining vertebrae. The diffusion seemed to be due to the longer remaining time of tetracycline HCl than that of calcein and alizarin red S in the body, which in turn produce a wider band in hard tissues formed during the same period of time. Accordingly, the use of calcein or alizarin red S, which have the characteristic of a short remaining time in the body, is recommended if labelling is intended more than twice within the shorter period of time. (Authors)

15003. Goncharov, G. D. 1971. DYNAMICS OF THE ACCUMULATION OF ANTIBODIES IN CARP IN RELATION TO THE INTERVALS OF INJECTION. (Dinamika Nakopleniya Antitel u Karpov v Zavisimosti ot Intervalov In"ektsii). Biologiya Vnutrennikh Vod, Informatsionnyĭ Byulleten' No. 9, AS USSR, "Nauka", Leningrad, pp. 44-47. Translated by Robert M. Howland.

The dynamics of the accumulation of antibodies in carp under optimal conditions of feeding and temperature regime for them in relation to the number of injections and the duration of the intervals between them was investigated. The process of accumulation of antibodies is realized better with a 10-day interval of two-stage inoculations, which completely ensure the effectiveness of revaccination with a decreased dose 1 and 2 months after the last primary inoculation.

15004. Goncharov, G. D. 1970. IMMUNOLOGICAL REACTION OF CARP KIDNEY CELLS. REPORT I. PHAGOCYTOSIS OF BACTERIA BY CARP KIDNEY CELLS IN VITRO. (Immunologicheskaya reaktsiya Kletok Pochek Karpa. Soobshchenie I. Fagotsitoz Bakterii Kletkami Pochek Karpa in vitro.). Biologiya vnutrennikh vod, Informatsionnyi Byulleten' No. 8, AS USSR, Leningrad, pp. 54-56. Translated by Robert M. Howland.

Data are presented dealing with phagocytosis in vitro by isolated kidney cells of immunized and intact carp. The arithmetic mean of the phagocytizing cells of immune carp was 66%, and intact ones - 37%. Phagocytosis of bacteria in vitro was accomplished for the most part by large and small lymphocytes.

15005. Wohlfarth, G., M. Lahman and R. Moav (Fish Culture Res. Sta., Dor, Israel). 1971. PRELIMINARY EXPERIMENTS IN GROWING CARP IN RECIRCULATING WATER. Bamidgeh, 23(4): 103-116.

A pilot plant for growing fish in recirculating water was constructed at the Fish Culture Research Station, Dor. The details of the plant which contained 24 asbestos tanks, each of 750 liter capacity, are described. Two preliminary experiments of growing carp fingerlings in this plant were conducted. The effects of the following variables on growth rate were tested: feeding rates, stocking rates, initial weights and genetic differences. Most frequent feeding (five times a day) was found to be better than less frequent feeding (twice a day), although the total daily ration was identical in the two regimes. The effect of stocking density on individual growth rate was not clear. Initial weight had a very strong effect on relative growth rate, and no differences in growth rate were found among three tested stocks despite the fact that their growth rates were highly variable when grown in ponds or in cages. (Authors)

15006. Avtalion, R. R., and A. Wojdani (Rappaport Labs. for Microbiol., Dept. of Life Sci., Bar Ilan Univ., Ramat Gan, Israel). 1971. ELECTROPHORESIS AND IMMUNOELECTROPHORESIS OF SERA FROM SOME KNOWN F_1 HYBRIDS OF TILAPIA. Bamidgeh, 23(4): 117-124.

Sera from 14 F_1 hybrids, deriving from the cross of Tilapia vulcani (nilotica) and T. aurea were analyzed by electrophoresis and immunoelectrophoresis for existence of genotype variations. Results show identifiable variabilities between the fast moving fractions (considered to be transferrins) of the electrophoregram which was carried out in flat polyacrylamide gel. At least 5 various F_1 hybrid types could be discerned. The preliminary results obtained in immunoelectrophoresis indicate some variabilities which exist between the hybrids, and are situated essentially at the slow moving immunoglobulin region. Isoantibodies could be obtained by immunizing parents against the F_1 hybrids' serum. (Authors summ.)

15007. Mann, H., E. Scherf, and M. Wassermann (Inst. für Küsten - und Binnenfischerei der Bundesforschungsanstalt für Fischerei, Hamburg, Germany). 1971. INFLUENCE OF WATER COVERING WITH FATTY ALCOHOLS ON THE WATER TEMPERATURE IN CARP PONDS (Einfluss der Wasserbedeckung mit Fettalkoholen auf die Wassertemperatur in Karpfenteichen). Archiv für Fischereiwissenschaft, 22(1): 68-78. In German with English summary.

It is known that fatty alcohols - in our example Alfol ^{R} WV-10 - applied to the surface of standing water, reduce the water evaporation. By the reduction of the water evaporation during periods of intensive warming up by sun irradiation considerable increases of temperature, especially in the surface zone, can be achieved. This increase of water temperature can be utilized for the breeding of carps. In our tests an average temperature increase of 0.7°C (April 28 to August 17, 1970) was achieved in the test pond by covering it with alcohol compared to the uncovered pond. The number of hours with temperatures over 20°C amounted to 533 for the test pond compared to 217 hours for the uncovered pond. In spite of the shortened growth time (April 28 to August 17, 1970) the weight of the fish in the covered pond had increased by about 150%, while the fish in the uncovered pond had only doubled their weight. (Authors summ.)

15008. Tan, Anna L., Alice DeYoung, and Robert W. Noble (Depts. of Medicine and Biochem., State Univ. of N. Y. at Buffalo, Buffalo, New York). 1972. THE pH DEPENDENCE OF THE AFFINITY, KINETICS, AND COOPERATIVITY OF LIGAND BINDING TO CARP HEMOGLOBIN, Cyprinus carpio. J. Biol. Chem., 247(8): 2493-2498.

The pH dependence of the equilibrium and kinetics of ligand binding to carp hemolysate and the purified hemoglobin components of carp hemolysate with O_2 and CO has been studied. The affinity of carp hemoglobin for O_2 at alkaline pH is 160 times that at acid pH. A large but significantly different pH effect on the affinity for CO is observed. pH also has different effects on the kinetics of the reactions with the two ligands. The change in the rate of O_2 dissociation over the pH range studied is 10 times that found for the rate of CO replacement by NO; and as previously reported, the change in the rate of combination of CO is twice that of O_2. The value of n in the Hill equation is pH-dependent for both ligands, being maximal at neutral pH and decreasing as the pH is shifted from neutrality. This decrease in the value of n is shown to be due not to heterogeneity in the carp hemoglobin but to be the result of an apparent decrease in the cooperativity of the ligand-binding reaction. At pH 5.6 and below, the value of n is 1.0 for CO and 0.75 for O_2 indicating no cooperativity. Below pH 5.6 and above pH 8.0, all equilibrium and kinetic constants are found to be unaffected by further pH changes. These results and the low, constant values of n are consistent with the hypothesis that at acid pH, carp hemoglobin, whether liganded or not, remains in a single low affinity conformation, perhaps that normally associated with the deoxygenated state. The hemoglobin appears to approach a similar situation at alkaline pH where the molecule has a high affinity similar to that of the ligand-saturated state. (Authors summ.)

15009. Lammert, H. (Inst. für Hydrobiologie und Fischereiwissenschaft der Univ. Hamburg und dem Inst. für Küsten - und Binnenfischerei der Bundesforschungsanstalt für Fischerei, Hamburg, Germany). 1971. METHODS OF AGE DETERMINATION IN SOLES (Zur Methode der Altersbestimmung an Seezungen). Archiv für Fischereiwissenschaft, 22(3): 200-213. In German with English abstract.

Subopercular and opercular bones, scales, otoliths and vertebrae of the sole were tested for age determination. Due to the difficult and frequently imperfect ringstructure opercular bones and scales were found less suitable for age determination. For the lower age groups otoliths brought good results. It became obvious that there are two secondary rings for the first two years of life, one for each year, in addition to the two winterrings. Comparisons of different methods demonstrated that the vertebrae of the sole give clearest and surest results for age determination. (Auth. summ.)

15010. Katayama, Teruhisa, Haruhiko Tsuchiya, and C. O. Chichester. 1971. THE BIOSYNTHESIS OF ASTAXANTHIN - V. INTERCONVERSION OF THE ALGAL CAROTENOIDS, Stigeoclonium sp. INTO FISH CAROTENOIDS, FANCY RED CARPS. Mem. Fac. Fish. Kagoshima, 20(1): 173-184. In English.

The carotenoids of fancy red carps (Cyprinus carpio Linne) were separated by absorption chromatography and further characterized by their absorption spectra and behavior on the column chromatography. In some cases melting points were measured and reactions for specific functional groups were performed. The principal carotenoids of the integument were lutein, α-doradexanthin, astaxanthin, and β-doradexanthin and in the internal organs the existence of canthaxanthin, lutein, and zeaxanthin was confirmed. The contents of the stomach of fancy red carps were examined and half-digested algae were found in them, the presence of chlorophylls was also confirmed. In the ponds where the carps were being raised, the alga, Stigeoclonium sp. was found. The carotenoids of the algae were separated and the presence of α-carotene, β-carotene, β-zeacarotene, echinenone, cantha-xanthin, lutein, zeaxanthin, violaxanthin and neoxanthin was confirmed. The metabolic pathway from the plant carotenoid, into fish carotenoid, was proposed. (Authors)

15011. Kashiwada, Ken-ichi, Akio Kanazawa, and Shin-ichi Teshima. 1971. STUDIES ON THE PRODUCTION OF B-VITAMIN BY INTESTINAL BACTERIA - VI. PRODUCTION OF FOLIC ACID BY INTESTINAL BACTERIA OF CARP. Mem. Fac. Fish. Kagoshima, 20(1): 185-189. In Japanese with English abstract.

Succeeding to the previous experiment, the production of folic acid by intestinal bacteria of carp was studied. In the first experiment, 4 groups of carp were fed respectively on the following diets: (A) complete diet devised by Halver, (B) diet deficient in both folic acid and p-aminobenzoic acid, (C) diet deficient in folic acid, and (D) diet supplementing 1% of sulfanilamide to the diet B. After being fed on the test diets for 10 days, the folic acid concentration in intestines was determined immediately after death, to the contrary, a part of intestine was incubated at 25°C for 6 hours, and similar determination was done. In the second experiment, hourly fluctuation of folic acid content in the intestine was examined on the four groups. In the first experiment, it was ascertained that the highest content of folic acid was observed in the intestines of carp fed on the diet A, while lesser content in the other three groups: B, C and D. Accordingly, the vitamin seems to be increased readily during incubation. As shown in the second experiment, folic acid was present in the intestinal canal 3 hours after feeding in all experimental groups, and its concentration reached a maximum after 6 hours. After being incubated for the more times, the vitamin content decreased markedly. From these results, it may be seen that folic acid is synthesized by intestinal bacteria of carp. (Authors)

15012. Masic, Djurdjica, and Reiner Hamm (Inst. für Chemie und Physik der Bundesanstalt für Fleischforschung, Kulmbach, Germany). 1971. ISOZYMES OF ASPARTATE AMINOTRANSFERASE IN THE SKELETAL MUSCLE OF CARP (Isozyme der Aspartat-Aminotransferase in der Skeletmuskulatur des Karpfens). Arch. FischWiss., 22(2): 110-120. In German with English summary.

The activity of aspartate aminotransferase (glutamate oxaloacetic transaminase; GOT; E.C. 2.6.1.1.) in tissue and press juice of the skeletal muscle of carps (Cyprinus carpio) was determined. The total GOT activity of the white carp muscle is of the same magnitude as the GOT acitvity of porcine M. longissimus dorsi. The red carp muscle shows higher GOT activity than the white muscle. In the extract of light carp muscle four GOT isozymes could be domonstrated after electrophoretic separation. One isozyme (GOT_s) is localized within the sarcoplasma, the other three isozymes (GOT_{M1}, GOT_{M2}, GOT_{M3}) are found in the mitochondrial fraction. About 80% of the total GOT activity of carp muscle is due to the activity of the mitochondrial isozymes. The three GOT_M isozymes have about the same activity. There is only a small decrease in total GOT activity in the muscle extract but a significant decrease in GOT_M activity of muscle press juice during storage of muscle at 4°C for 48 hours post mortem. The GOT_M

activity increases. It is possible that this effect is due to a damage of mitochondrial membranes caused by the high rate of post-mortem changes (e.g. breakdown of ATP) in the excised carp muscles. (Authors summ.)

15013. Bootsma, R. (Special Animals' Dept., Fac. of Vet. Medicine, Biltstraat 172, Utrecht, the Netherlands). 1972. EPIZOOTIC SWIM BLADDER DISEASE OF CARP IN THE NETHERLANDS. Neth. J. vet. Sci., 4(2): 125-139, illus.

In the Netherlands, epizootic swimbladder disease of carp (SBD) was observed for the first time in 1968. The clinical picture is briefly reviewed. The aetiology continues to be obscure; the experience so far gained with the disease suggests an infective agent. Eighteen species of bacteria were isolated on bacteriological examination of five diseased carp. Preliminary experimental infection with three species showed that only A. hydrophila was pathogenic. The typical changes of the swimbladder were not reproducible. Treatment has hardly any effect on SDB. Long-term oral administration of the antibiotic oxytetracycline produced some improvement. Moreover, the disease was found to run a milder course when the individual resistance of the carp was increased by improving the diet. Mortality usually is rather low but the extremely chronic course run by the disease makes it difficult to determine the ultimate death rate. A large number of carp populations in inland waters in the Netherlands have to be regarded as infected. (Auth. summ.)

15014. Bartholomew, J. Philip. 1972. AN EVALUATION OF COVER RETENTION AS RELATED TO ANGLING QUALITY IN LAKE McCLURE (NEW EXCHEQUER RESERVOIR), MARIPOSA COUNTY, CALIFORNIA. The Resources Agency of Calif., Dept. of Fish & Game, Inland Fish. Administrative Report No. 72-7, 15 p.

A creel census was conducted on Lake McClure to assess the value of vegetation retention to the angler. For the purpose of this study, a large cover retention area (Cotton-Temperance Cove) and a large cover removal area (Horseshoe Bend) were chosen to compare angling quality. The cover retention area accounted for more than 75% of the number of anglers present and the number of angler hours censused, and more than 75% of largemouth bass, Micropterus salmoides, and sunfishes (bluegill, Lepomis macrochirus, green sunfish, Lepomis cyanellus, red-ear sunfish, Lepomis microlophus) harvested, even though access to the cover retention is by boat only rather than by road as in the cover removal area. The construction of recreational areas (boat ramps, campgrounds) around the reservoir during the study period affected angler distribution. Recommendations are made to begin a new program to evaluate the effects of cover retention on newly hatched and young-of-the-year largemouth bass. (Auth. summ.)

15015. Tilton, R. C., John Murphy, and J. K. Dixon (School of Medicine, Univ. of Conn., Hartford, Connecticut). 1972. THE FLOCCULATION OF ALGAE WITH SYNTHETIC POLYMERIC FLOCCULANTS. Water Research, 6(2): 155-164.

The flocculation of a pure algal culture of Chlorella ellipsoidia was evaluated by means of measurements of filtration rate, light transmission and electrophoretic mobility, at algal concentrations of 50-3000 mg l^{-1}, polymer concentrations of 0.01-1000 mg l^{-1} at pH 4-7. Non-ionic and anionic polyacrylamides, and anionic polystyrene sulfonate with molecular weights of about 1,000,000 failed to show any flocculation at polymer concentrations from 0.01 to 200 mg l^{-1}. Cationic polyethyleneimine was effective as a flocculant as shown by the results from the three methods of measurement. There was a significant increase in flocculation efficiency as the polymer molecular weight increased from 800 to about 2000 but little improvement above 2000. An effect of pH from 4 to 7 was absent. A variation in the magnesium ion concentration from 2.45 to 0.005 g l^{-1} in the nutrient did not produce any effect. Earlier results with crystalline silica and E. coli and these same polymers had shown a similar effect of molecular weight and an influence of pH. A brief discussion is presented on a comparison of results on algae with those of other colloids, it being especially significant that at the same concentration of biocolloid the algae need about 100 times higher concentration of polymer than do E. Coli. (Authors)

15016. Johnson, R. P. (Fish. & Wildl. Branch, Saskatchewan Dept. of Natural Resources, Saskatchewan, Canada). 1971. LIMNOLOGY AND FISHERY BIOLOGY OF BLACK LAKE, NORTHERN SASKATCHEWAN. Fish. & Wildl. Branch, Dept. of Natural Resources, Province of Saskatchewan, Fisheries Report No. 9, 47 p.

The 24,700 sq. miles which drain through Black Lake lie in the MacKenzie River system. Annual runoff is 8 million acre-ft; theoretical flushing time of the lake is 8.5 months. Since 1966 water levels have fluctuated through 3.5 ft. The altitude of Black Lake is 922 ft. above sea level. The water area of the lake is 172 sq miles. Maximum depth is 192 ft. and mean depth is 51 ft. Strong, stable, thermal stratification develops in Black Lake and prevents warming of bottom water. The highest bottom temperature recorded was 45 F at 140 ft. in the main lake, and 48 F at 80 ft. near Black Lake settlement. The lowest oxygen recorded was 5.6 cc/liter. Average surface water pH was 7.1 with bottom pH slightly lower. The mean seasonal transparency is 18 ft. in the main body of Black Lake. Total dissolved minerals are low, from 10-20 ppm. The ionic composition is a calcium bicarbonate type water typical of Precambrian shield lakes. The standing crop of plankton (dry weight) is calculated at 20.4 lb/ac in the main body of Black Lake. The bottom fauna, dominated by amphipods, has a standing crop of 4.1 lb/ac. These low standing crops are typical of Precambrian shield lakes. Seventeen kinds of fish were captured. Trout and lake whitefish were prominent in the gillnet catches, with lesser numbers of longnose suckers and burbot. The average catch per standard-gang gillnet was 206 lb, relatively heavy among Saskatchewan lakes. Arctic grayling are confined to streams during the summer in this area. Spawning lasts from 3 to 7 days; it has taken place as early as May 18-23 and as late as June 9-12. By mid-August young-of-the-year may be 3 inches long. Growth is intermediate between that in Lake Athabasca and Reindeer Lake. It was the same in 1969 as it was in 1955. Netting of spawning grayling and heavy angling at the Fond du Lac River exit appear to have reduced the size of fish here; larger specimens (up to 4 lb) are available farther downstream. A potential production and life history study is needed to manage the grayling fishery. Lake whitefish are abundant throughout the lake. Growth is slow in Black Lake compared to more southern Saskatchewan lakes. Food is mainly sphaeriids, chironomids, and amphipods. When the food eaten is compared with bottom population, selection of food or feeding areas is apparent. Lake trout are abundant in the deeper water of Black Lake. Growth is a little slower than in Lac la Ronge. The largest trout captured by the survey was 26.5 lb. The food eaten was nearly all fish; ciscoes and whitefish were the main prey species. Northern pike are concentrated in shallower areas including Cree Bay and Giles and Wapata Lakes. Growth is rapid, similar to that at more southern latitudes in Saskatchewan. Food eaten was mainly fish. Favored walleye habitat includes Cree Bay and the Fond du Lac River entrance, in water shallower than 30 ft. Growth is considerably slower than in Lac la Ronge and 50% slower than in the Qu'Appelle Valley. Food eaten was about 95% fish; ciscoes, suckers, and lake chubs were identified from stomachs. The minimum stretched measure mesh size of 5-inch is too large to effectively harvest whitefish or walleyes. This should be lowered to 4-1/2-inch for both the domestic and commercial fisheries. The domestic use of fish is for human and dog food, the latter being the heaviest. A survey in the fall of 1969 revealed about 550 dogs at Black Lake. A crude estimate of domestic use of fish from Black Lake is 100,000 lb, about 1 lb/ac. The sport fishery entertaining 650 anglers is estimated at 40,000 lb. annually. Species harvested include grayling, trout, walleye, and pike. Infrequent walleye or pike fishing is done in Black Lake, most being concentrated in Wapata Lake. Grayling are taken only in the Fond du Lac River between Black and Stony Lakes. Trout are widespread throughout Black Lake immediately after breakup. As the lake warms they concentrate in deeper water near islands along the north shore. The number of large trout is reportedly decreasing; this may be attributed to netting for dog food and intensive angling for trophy fish. Domestic use of trout in the fall and of grayling in the spring should be discouraged since local residents gain considerable revenue from the sport fishery as guides and camp assistants. The commercial fishery has been intermittent since its inception in 1958. Problems include cost of transportation and lack of experience in fishing by the local people. A whitefish limit of 100,000 lb is suggested. It is recommended

that trout be removed from the list of commercial species for Black Lake to protect trophy specimens and reduce conflict with the sport fishery. Assuming a commercial whitefish removal of 100,000 lb. the total production from Black Lake by all fisheries would be 240,000 lb. (2.2 lb/acre). With 90,000 lb. commercial limit on Giles and Wapata Lakes, 190,000 lb. commercial catch is available in the management area. (From Auth. summ.)

15017. Krupauer, V. 1971. THE USE OF HERBIVOROUS FISH FOR AMELIORATIVE PURPOSES IN CENTRAL AND EASTERN EUROPE. Proc. Eur. Weed Res. Coun. 3rd int. Symp. aquatic Weeds, Oxford, 95-103. [Bibl. 17; En, fr, de; Vyzk. Ustav ryb., Vodnany, Czechoslovakia]; Weed Abstracts, 21(1), abstract No. 240.

In monoculture, 3-year-old grass carp have destroyed 80-100% of submerged plants in trials in ponds and canals in Czechoslovakia and up to half of the emergent plants during the course of the growing season; high stocking rates had to be maintained. Recommended stocking rates for weed control in ponds ranged from 2000 30-g (1-year-old) fish/ha to 150 1400-g (4-year-old) fish, i.e., total weights of stocked fish of from 60 kg to 210 kg/ha, respectively. Plants controlled were Polygonum amphibium, Trapa natans, Elodea canadensis, Potamogeton natans, P. lucens, Glyceria maxima, Phalaris arundinacea, Phragmites communis, Typha latifolia and T. augustifolia. Successful control was also achieved in canals with a single stocking of 300-400 three-year-old grass carp/1-1.5 ha. Silver carp (Hypophthalmichthys molitrix) > 15 mm long fed on phytoplankton; diatoms and green algae were preferred. The temperature requirement of silver carp was too high for good growth in Czechoslovakia. Bighead (Aristichthys nobilis) fed on both phyto- and zooplankton; of the phytoplankton bighead preferred diatoms and green algae but, unlike silver carp, would also eat blue-green algae such as Microcystis sp. The present position of and prospects for herbivorous fish production in the individual countries of central and eastern Europe are summarized.

15018. Marshall, T. Lawrence, and Ronald P. Johnson (Dept. of Fish. & Wildl. Biol., Colo. State Univ., Fort Collins, Colorado). 1971. HISTORY AND RESULTS OF FISH INTRODUCTIONS IN SASKATCHEWAN 1900-1969. Dept. of Natural Resources, Fish. & Wildl. Branch, Province of Saskatchewan Fisheries Report No. 8, 30 p.

Since 1900, 1.6 billion fish comprising 30 species have been introduced to fresh and saline waters of Saskatchewan. Indigenous species widely distributed into saline and new waters include lake whitefish (Coregonus clupeaformis), ciscoes ("Coregonus artedii complex"), walleye (Stizostedion vitreum), perch (Perca flavescens) and northern pike (Esox lucius). The ranges of Arctic grayling (Thymallus arcticus) and lake trout (Salvelinus namaycush) have been extended southward. Introductions of a few "minnows" and catostomids as forage for other species were made but never assessed. Exotic species that have exhibited natural reproduction include the largemouth bass (Micropterus salmoides), smallmouth bass (Micropterus dolomieui), brook trout (Salvelinus fontinalis), brown trout (Salmo trutta), and rainbow trout (Salmo gairdneri). Goldfish (Carassius auratus) flourished but were eradicated during spawning. Survival without reproduction has been demonstrated by the American eel (Anguilla rostrata), kokanee (Oncorhynchus nerka), and splake (Salvelinus fontinalis x S. namaycush). American smelt (Osmerus mordax), crappies (Pomoxis sp.), bluegill (Lepomis macrochirus), alpine char (Salvelinus alpinus) and an unspecified ictalurid failed to survive. An introduction of coho salmon (Oncorhynchus kisutch) remains to be assessed. A variety of factors influenced the survival of species in new environments. These include dissolved oxygen, temperature, quality and quantity of dissolved minerals, stability of water levels, availability of spawning areas, predation, shade, food supply, incomplete detoxification of rehabilitated lakes, and viability of introduced stock. (Authors)

15019. Chervinski, J., and A. Yashouv (Fish. Cult. Res. Sta., Dor, Israel). 1971. PRELIMINARY EXPERIMENTS ON THE GROWTH OF Tilapia aurea, Steindachner (PISCES, CICHLIDAE) IN SEAWATER PONDS. Bamidgeh, 23(4): 125-129.

15020. U. S. Office of Water Resources Research (Washington, D. C.). 1972. PCB IN WATER - A BIBLIOGRAPHY. Water Resources Scientific Information Center, Report WRSIC 72-201, 40 p. ; Selected Water Resources Abstracts, 5(8): p. 36.

This is a collection of 25 abstracts for selected reports and journal articles published in 1969, 1970, and 1971. The abstracts include full bibliographical citatations and a set of descriptors from the Water Resources Thesaurus. The bibliography is a computer printout from the information base comprising only Selected Water Resources Abstracts (SWRA), which had 35,675 abstracts on December 15, 1971 when the search was made. A significant descriptor index is given of representative weighted terms that best describe the information content of the abstracted items.

15021. U. S. Office of Water Resources Research (Washington, D. C.). 1971. DETERGENTS IN WATER - A BIBLIOGRAPHY. Water Resources Scientific Information Center Report WRSIC 71-214, 460 p.; Selected Water Resources Abstracts, 5(8): p. 40.

A compilation of 282 abstracts is presented for selected reports, journal articles, and various documents published mostly since 1966 on the subject. The abstracts include full bibliographical citations and a set of descriptors from the Water Resources Thesaurus. The bibliography is produced from two computerized information bases that complement each other in summarizing completed and ongoing research as documented by the Water Resources Scientific Information Center: (1) Selected Water Resources Abstracts (SWRA) and (2) Notices of Research Projects (NRP). Descriptions are given for 44 research projects in progress as registered with the Smithsonian Science Information Exchange. At the time of computer search for this bibliography, the SWRA information base contained almost 35,000 items. A significant descriptor index is given of representative weighted terms that best describe the information content of the abstracted items. A comprehensive index is given that represents all descriptors and identifiers used to index the different papers in the bibliography. Items in the bibliography are arranged in ascending WRSIC Accession No. sequence.

15022. U. S. Office of Water Resources Research (Washington, D. C.). 1972. MERCURY IN WATER - A BIBLIOGRAPHY. Water Resources Scientific Information Center, WRSIC 72-214, 294 p.; Selected Water Resources Abstracts, 5(8): p. 40.

This is a compilation of 195 abstracts for selected reports, journal articles, and various documents published mostly since 1967 on mercury in water. The abstracts include full bibliographical citations and a set of descriptors from the Water Resources Thesaurus. This bibliography supercedes an earlier edition on the subject (WRSIC 71-207), and is produced from two complementary computerized information bases. One base contains Selected Water Resources Abstracts (SWRA) and the other contains Notice of Research Projects (NRP). The SWRA portion represents published research in water resources, as abstracted and indexed in the SWRA journal. At time of the computer search for this bibliography the data base had 35,675 abstracts covering SWRA through December 15, 1971. Notices and descriptions are given for 10 research projects underway on mercury in water; these are registered with Smithsonian Science Information Exchange. A significant descriptor index is given of weighted terms that best describe the information content of the abstracted items. A comprehensive index lists all descriptors and identifiers used to index each paper represented by an abstract. The bibliography is arranged in ascending WRSIC Accession No. order.

15023. Sokol'skaya, N. L. 1962. NEW DATA ON THE FAUNA OF NAIDIDAE (OLIGOCHAETA) OF LAKE BAIKAL. (Novye Dannye po Faune Naididae (Oligochaeta) Ozera Baĭkal). Maloshchetinkovye Chervi i Planarii Ozera Baĭkal, Akademiya Nauk SSSR, Sibirskoe Otdelenie, Trudy Limnologicheskogo Instituta, Vol. 1 (XXI), No. 1, Moscow-Leningrad, pp. 127-151. Translated by Robert M. Howland.

15024. Born, Stephen (Water Resources Research Center, Maine Univ., Orono, Maine). 1971. INLAND LAKE RENEWAL: CORRECTION TECHNIQUES, DEMONSTRATION METHODS, SUCCESSES AND FAILURES. Proc., Workshop--Conference on reclamation of Maine's dying lakes, held at Univ. of Maine, Bangor, March 24-25, 1971, pp. 19-24; Selected Water Resources Abstracts, 5(8): p. 50.

The Wisconsin Inland Lake Renewal Demonstration Project including amelioration and protection of lakes is described. Among the reclamation measures, the following are most common: diversion of wastewaters, reduction of phosphorus supply by additions of aluminum, iron, or lime, and land use control through zoning, sanitary codes, and subdivision ordinances. Other methods of limiting lake fertility include dredging removal, or exposure and oxidation of lake sediments, harvesting of fish and vegetation, destratification by artificial aeration, and the use of bottom sealants. Maintenance of lakes is largely dependent on the introduction of predatory or parasitic organisms, such as insects, fish, and viruses, and an occasional limited use of eradicants--sodium arsenate and 2,4-D.

15025. Klement, Alfred W., Jr., and Vincent Schultz (Div. of Radiation Protection Standards (AEC), Washington, D. C.). 1971. TERRESTRIAL AND FRESHWATER RADIOECOLOGY. A SELECTED BIBLIOGRAPHY. Available from Natl. Tech. Information Serv., Springfield, Va. 22151 as TID-3910 (Suppl. 7), $3.00 paper copy, $0.95 microfiche. TID-3910 (Suppl. 7), October 1971, 219 p.; Selected Water Resources Abstracts, 5(8): p. 51.

The seventh supplement to the bibliography issued in March 1962 lists 2443 references and 36 bibliographies, in alphabetical order by the first author. There is no subject index. An attempt was made to reference publications related to wild species of plants and animals with respect to radiation effects or metabolic studies involving radionuclides. Studies of laboratory or domestic organisms have not in general been included unless such studies are ecological in nature, e.g., on population growth or synergistic. Studies of brackish water and brackish water organisms are included. Environmental monitoring is included only when natural waters and wild animals or plants are involved.

15026. Hall, Millard W. (Water Resources Research Center, Maine Univ., Orono, Maine). 1971. EUTROPHICATION - THE PROBLEM - DETECTION - EXTENT. Proc., Workshop--Conf. on reclamation of Maine's dying lakes held at Univ. of Maine, Bangor, March 24-25, 1971, pp. 5-13; Selected Water Resources Abstracts, 5(8): p. 49.

Natural and cultural eutrophication are defined and stress is placed on the limited possibilities available to man in his efforts to reduce the accumulation of nutrients in water basins and to liquidate the resulting biological 'imbalance.' Particular emphasis is placed on the futility of algal control by copper sulfate and other chemicals. Diversion of wastewaters may prevent the cultural eutrophication of certain lakes, e.g., Lake Annabessacook, but only at the cost of polluting a river. The use of inocula of parasitic viruses may achieve control of blue-green algae.

15027. Fontenot, Bennie J., Jr., and Howard E. Rogillio. 1970. A STUDY OF ESTUARINE SPORTFISHES IN THE BILOXI MARSH COMPLEX, LOUISIANA. La. Wild Life and Fish. Comm., Baton Rouge, Louisiana 70804, 172 p.

This study, an investigation of estuarine sportfishes of the Biloxi Marsh Complex, presented to the sportsmen key factors in the habits and life histories of these fishes. The family Scaienidae was the dominant family and contained the most sought-after species by sportsfishermen. The sheepshead, Archosargus probatocephalus, family Sparidae, was also an important sportfish which existed abundantly in the study area. Catch of the various scaienids and of the sheepshead was correlated to date, salinity, tidal condition and water temperature at time of capture. Food habits, spawning habits, movement data, and size distribution were also presented. A discussion of the other fishes captured concurred but was not as detailed. Hydrological data presented in this study consisted of pH, free carbon dioxide, alkalinity, chlorinity, salinity, water temperature, tidal condition and turbidity. This study was initiated July, 1960, lasted for eight years and terminated June, 1968. (Authors)

15028. Donaldson, Edward M., James D. Funk, F. C. Withler, and R. B. Morley (Fish. Res. Bd. of Canada, Vancouver Lab., West Vancouver, Brit. Columbia, Canada). 1972. FERTILIZATION OF PINK SALMON (Oncorhynchus gorbuscha) OVA BY SPERMATOZOA FROM GONADOTROPIN-INJECTED JUVENILES. J. Fish. Res. Bd. Canada, 29(1): 13-18.

Sexual maturation in male pink salmon (Oncorhynchus gorbuscha) from Jones Creek, a tributary of the Fraser River, British Columbia, was accelerated by intraperitoneal injections of partially purified chinook salmon (O. tshawytscha) gonadotropin. The treated pinks produced milt 1 year earlier than normal. Milt from these fish was compared with milt from wild Lower Babine River pinks with respect to its ability to fertilize the ova of Lower Babine River females. There were no marked differences in proportions of ova fertilized, in survival to hatching, or in numbers of deformed larvae. Densities of sperm in the milt from treated males ranged from 0.15×10^9 to 7.35×10^9 per ml; sperm densities in the milt from wild males ranged from 19.3×10^9 to 38.6×10^9 per ml. Two stages in testicular development were identified among the treated males and found to be directly related to the success of fertilization. The significance of induced early maturation in attempts to establish pink runs in the "off" year rivers is discussed. (Authors)

15029. Hatfield, C. T., and J. M. Anderson (Fish. Res. Bd. of Canada Biol. Sta., St. Andrews, New Brunswick, Canada). 1972. EFFECTS OF TWO INSECTICIDES ON THE VULNERABILITY OF ATLANTIC SALMON (Salmo salar) PARR TO BROOK TROUT (Salvelinus fontinalis) PREDATION. J. Fish. Res. Bd. Canada, 29(1): 27-29.

The experiments were conducted in large outdoor concrete pools in which the salmon had access to a safe haven. After exposure for 24 hr to 1.0 ppm of the organophosphate insecticide, Sumithion, Atlantic salmon (Salmo salar) parr were more vulnerable than unexposed fish to predation by large brook trout (Salvelinus fontinalis). Sumithion at 0.1 ppm, and DDT at 0.07 ppm, had no noticeable effect. The results, particularly for Sumithion, correlate well with previous laboratory work on the effect of insecticides on the learning ability of salmon. (Authors)

15030. Kleerekoper, H., G. F. Westlake, J. H. Matis, and P. J. Gensler (Texas A&M Univ., College Station, Texas 77843). 1972. ORIENTATION OF GOLDFISH (Carassius auratus) IN RESPONSE TO A SHALLOW GRADIENT OF A SUBLETHAL CONCENTRATION OF COPPER IN AN OPEN FIELD. J. Fish. Res. Bd. Canada, 29(1): 45-54.

In slowly flowing water, seven naive goldfish 30-cm long changed their locomotor behavior upon entering a mass of water containing shallow gradients of copper chloride. The concentration was 11-17 μg/liter Cu^{++} in most of this mass, with small isolated pockets containing maximally 50 μg/liter. The amount of time spent by the fish, the average size of turn, and the variance of the size of turn increased in the "polluted" region. The orientation of the fish in this region deviated consistently in the upstream direction resulting in the increase in time spent in the area of highest concentration. Comparison of the locomotor behavior of the fish in sodium chloride of the same concentration and in laboratory water established that the changes mentioned were in response to the copper rather than the chloride ion. (Authors)

15031. Proto, Daniel, and Robert A. Sweeney (Great Lakes Lab., State Univ. College at Buffalo, Buffalo, New York 14201). 1972. ANNOTATED BIBLIOGRAPHY OF LAKE ONTARIO LIMNOLOGICAL AND RELATED STUDIES. I. - CHEMISTRY. Great Lakes Laboratory, State Univ. College at Buffalo, Special Report No. 10, 102 p.

15032. Downing, Elaine P., James E. Hassan, and Robert A. Sweeney. 1972. ANNOTATED BIBLIOGRAPHY OF LAKE ONTARIO LIMNOLOGICAL AND RELATED STUDIES. II. - BIOLOGY. Great Lakes Laboratory, State Univ. College at Buffalo, Special Report No. 11, 236 p.

15033. Baldwin, John, and Robert A. Sweeney. 1972. ANNOTATED BIBLIOGRAPHY OF LIMNOLOGICAL AND RELATED STUDIES ON LAKE ONTARIO AND ITS TRIBUTARIES. III. - PHYSICAL. Great Lakes Laboratory, State Univ. College at Buffalo, Special Report No. 12, 207 p.

15034. Amend, Donald F., and John P. Pietsch (U. S. Bur. of Sport Fish. & Wildl., Western Fish Disease Lab., Seattle, Washington 98115). 1972. VIRUCIDAL ACTIVITY OF TWO IODOPHORS TO SALMONID VIRUSES. J. Fish. Res. Bd. Canada, 29(1): 61-65.

Wescodyne[R] and Betadine[R], organic iodine complexes, were compared in vitro for virucidal activity against infectious hematopoietic necrosis (IHN), infectious pancreatic necrosis (IPN), and viral hemorrhagic septicemia (VHS) viruses. Both iodophors were about equally effective on all three viruses. Each iodophor completely destroyed IHN virus within 30 sec at 12 ppm iodine, and was not affected by water hardness. Virucidal activity, however, was reduced at pH levels above 8.0 and in the presence of organic matter. Wescodyne was also compared with seven disinfectants commonly used in fish hatcheries, for virucidal properties against IHN virus. Wescodyne and chlorine were the only disinfectants to completely destroy the virus. Either Wescodyne or Betadine would effectively destroy the salmonid viruses at less than 25 ppm iodine within 5 min in solutions near neutrality. (Authors)

15035. Muir, B. S., and A. J. Niimi (Fish. Res. Bd. of Canada, Marine Ecol. Lab., Bedford Inst., Dartmouth, Nova Scotia, Canada). 1972. OXYGEN CONSUMPTION OF THE EURYHALINE FISH AHOLEHOLE (Kuhlia sandvicensis) WITH REFERENCE TO SALINITY, SWIMMING, AND FOOD CONSUMPTION. J. Fish. Res. Bd. Canada, 29(1): 67-77.

Active and standard metabolism of Kuhlia sandvicensis increase with fish weight to a power of about 0.8 and active is nine times standard. No significant difference was found between experiments in fresh water and 30 ‰ sea water at 23 C. At low swimming speeds the fish may be unable to physically take up as much oxygen as at higher speeds. Swimming activity may be essential to circulatory adequacy. Elevated oxygen consumption lasted for 42 hr following a ration of 2.3% of body weight and for 60 hr after one of 4.5%. It amounted to about 76 mg O_2/g ration, equivalent to about 16% of the energy of the ration, in both cases. For a nonswimming fish the highest oxygen consumption observed following the maximum daily ration is no more than half of the difference between active and standard rates. (Authors)

15036. Wojtowicz, M. B., and P. H. Odense (Fish. Res. Bd. of Canada, Halifax Lab., Halifax, Nova Scotia, Canada). 1972. COMPARATIVE STUDY OF THE MUSCLE CATHEPTIC ACTIVITY OF SOME MARINE SPECIES. J. Fish. Res. Bd. Canada, 29(1): 85-90.

The hemoglobin-splitting activity and the autolytic- (endogenous) catheptic activity of the white skeletal muscle of 13 Atlantic fish species were measured and found to be low relative to the catheptic activity of other tissues. On the other hand, catheptic activities of lobster and crab claw muscles were high. Lobster tail muscle showed little activity, a factor perhaps contributing to its tougher texture relative to the claw muscle. The individual variations between samples of the same species were great and the ranges of the species overlapped each other with no evident phylogenetic distinction. The hemoglobin-splitting activity was always higher and was always directly correlated with the autolytic activity for each individual sample. Using an urea-free hemoglobin substrate pH optima were found in the range 3.0-3.6. Urea shifted the pH optima upwards approximately 0.4 unit. Fish muscle cathepsins were found to have the same level of activity as chicken muscle. (Authors)

15037. Cronin, L. Eugene, and Alice J. Mansueti (Chesapeake Biol. Lab., Nat. Res. Inst., Univ. of Maryland, Solomons, Maryland 20688). 1971. THE BIOLOGY OF THE ESTUARY. Reprint from: A Symposium on the Biological Significance of Estuaries. Sport Fishing Inst., Washington, D. C., 39 p. illus.

15038. Everest, F. H., and D. W. Chapman (Idaho Coop. Fish. Unit, Univ. of Idaho, Moscow, Idaho 83843). 1972. HABITAT SELECTION AND SPATIAL INTERACTION BY JUVENILE CHINOOK SALMON AND STEELHEAD TROUT IN TWO IDAHO STREAMS. J. Fish. Res. Bd. Canada, 29(1): 91-100.

During summer sympatric steelhead trout and summer chinook salmon segregated in Crooked Fork and Johnson creeks. In short-term allopatry, each species occupied the same types of habitat as in sympatry. Most age 0 steelhead lived over rubble substrate in water velocities and depths of less than 0.15 m/sec and 0.15 m, respectively; most age 0 chinook lived over silt substrate in water velocities of less than 0.15 m/sec and depths of 0.15-0.3 m; most age I steelhead resided over large rubble substrate in water velocities of 0.15-0.3 m/sec (near bottom) and 0.75-0.9 m/sec (near surface), and in depths of 0.6-0.75 m. As fish of each species became larger they moved into faster, deeper water. Juvenile chinook and steelhead of the same size used the same physical space. But steelhead spawn in spring and chinook spawn in early fall, and disparate times of spawning create discrete intra- and inter-specific size groups of pre-smolts. The size differences minimize potential for social interaction, both intra- and interspecific. (Authors)

15039. Davis, J. C. (Univ. of British Columbia, Dept. of Zool., Vancouver 8, British Columbia, Canada). 1972. AN INFRARED PHOTOGRAPHIC TECHNIQUE USEFUL FOR STUDYING VASCULARIZATION OF FISH GILLS. J. Fish. Res. Bd. Canada, 29(1): 109-111.

An infrared photographic technique was used to study patterns of blood distribution within gills of intact trout. Injection of adrenaline in the subintestinal vein produced a marked change in photographic appearance of the gill as it appeared swollen with blood and more blood was visible in the lamellae at the gill filament tips. The technique appears useful for studying large changes in gill vascularization. (Auth.)

15040. Orlowski, Stanley J., Sidney S. Herman, Richard G. Malsberger, and Hayden N. Pritchard (Dept. of Biol. and Center for Marine and Environmental Studies, Lehigh Univ., Bethlehem, Pennsylvania 18015). 1972. DISTINGUISHING CUNNER AND TAUTOG EGGS BY IMMUNODIFFUSION. J. Fish. Res. Bd. Canada, 29(1): 111-112.

This note describes a simple and rapid immunodiffusion method used to distinguish Tautoga onitis (tautog) eggs from those of Tautogolabrus adspersus (cunner). These closely related species have eggs so similar in their early stages that positive identification was considered virtually impossible using previously established techniques. (Authors)

15041. Worthington, R. E., T. S. Boggess, Jr., and E. K. Heaton (Dept. of Food Sci., Univ. of Ga. College of Agric. Exp. Stations, Ga. Sta., Experiment, Georgia 30212). 1972. FATTY ACIDS OF CHANNEL CATFISH (Ictalurus punctatus). J. Fish. Res. Bd. Canada, 29(1): 113-115.

Representative samples of channel catfish (Ictalurus punctatus Rafinesque) were obtained from five processing plants and analyzed by gas-liquid chromatography for fatty acid composition of muscle tissues. Twenty-three fatty acids were measured. The saturated fatty acids comprised 26.5%, monoenes 48.1%, dienes 13.0%, trienes 3.1%, tetraenes 3.6%, pentaenes 1.3%, and hexaenes 1.9% of total fatty acids. Fatty acid composition varied significantly ($P < .01$) among fish obtained from the same plant, and in addition, significant variation associated with processing plant was observed for some fatty acids. (Authors)

15042. FAO of the United Nations (Rome, Italy). 1972. REPORT OF THE FIRST MEETING OF THE FAO AD HOC WORKING PARTY ON GENETIC SELECTION AND THE CONSERVATION OF GENETIC RESOURCES OF FISH. ROME, ITALY, 7 - 10 DECEMBER 1971. FAO Fisheries Report No. 119, 9 p.

15043. Kennedy, M., and P. Fitzmaurice (Inland Fisheries Trust, Dublin, Ireland). 1971. GROWTH AND FOOD OF BROWN TROUT Salmo trutta (L.) IN IRISH WATERS. Proc. Royal Irish Academy, 71(B): 269-352, 5 plates, 2 appendices.

The authors examined sets of scales from 3253 brown trout from more than 40 Irish streams and rivers and from some 76 lakes and reservoirs. Creel census returns and data provided by the Irish Specimen Fish Committee were also analysed. In running water, the largest and fastest-growing trout occurred in streams and rivers of high calcium content in limestone areas. The mean lengths of trout in such waters, at 2, 3 and 4 years old, were respectively 20, 30 and 35-40 cm. The smallest and slowest-growing trout occurred in lime-deficient waters draining acid rocks. The mean lengths of trout at 2, 3 and 4 years old, in such waters, were in some cases as low as 12, 15-16 and 17-18 cm respectively. In general, there was a correlation between bicarbonate alkalinity and trout growth, but there were some anomalies; notably some sandstone rivers, e.g. the Bandon in which growth was good, and some granite rivers in which calcareous drift made the water decidedly alkaline in reaction, e.g. the upper Slaney, but in which growth was poor. In lakes, the growth of trout was characteristically fast in alkaline waters and slow in acid waters. Length-for-age of lake trout was also affected by the length of time the young trout spent in the tributary streams before migrating to the lake. The mean length of lake trout at 4 years of age varied from as little as 20-25 cm in relatively unproductive lakes to as much as 35 to 40 cm in rich lakes. In small lakes there was a tendency for the growth of the trout to be inversely proportionate to the stock density and there were instances of quite fast growth in some relatively barren lakes in which, because of restricted spawning facilities, there were very few trout. Very large 'ferox' (fish-eating) trout weighing 4500 to 9000g occurred in some large lakes; they were fairly common in lakes of moderate bicarbonate alkalinity (1.0 to 2.0 mEq/l) such as Corrib and Mask but rare in highly alkaline lakes such as Lough Ennell, in which invertebrate food was more abundant. Trout transplanted from waters in which growth is slow to alkaline lakes rich in food grew rapidly and became large fish. They usually became silvery in colour and developed red flesh. In Irish rivers, most trout of both sexes spawn for the first time when three years old, provided they have attained by then a critical (minimum) length, which is less than the mean but well above the minimum L3 for the river in question. In lakes in which trout grow slowly, both sexes tend to spawn for the first time when three years old. In rich lakes, however, most female trout are four years old, or older, at first spawning, but males may be mature at three years old. In rivers, trout, once mature, usually spawn each winter. In lakes, in contrast, a proportion of adult trout of both sexes are in non-spawning condition in any given winter. Some individuals spawn in consecutive winters; others miss a year. Stomach contents data were available for 386 stream and river trout, 1052 lake trout and 842 reservoir trout. In limestone rivers and streams, Gammarus and/or Asellus were the chief food of the trout in early spring. Simulium larvae also being of considerable importance where they were especially numerous (e.g. the Little Brosna). In summer, the limestone river trout fed mainly on emerging and winged insects, chiefly of aquatic origin. In sandstone and granite rivers, trout in early spring fed on a wide range of invertebrates, amongst which cased caddis were sometimes dominant (e.g. the Slaney); in summer they took surface insects, many of them terrestrial forms. In lakes, the smaller trout fed extensively on Cladocera. In the midland lakes (Sheelin, Ennel, Owel, Derravaragh) trout are older and larger than in the big western lakes (Corrib, Mask) before they cease to feed almost exclusively on Cladocera and so begin to be cropped by anglers. In the limestone lakes, trout in the size range usually caught by anglers fed mainly on Gammarus, Asellus, molluscs, cased caddis larvae, corixids, emerging and adult insects and small fish (perch fry and sticklebacks). Insects taken at or close to the surface included chironomids (taken mainly as pupae during the period late April to July); Ephemera danica (mid-May to mid-June); Trichoptera (taken mainly in July-August); and terrestrial insects. Molluscs and terrestrial insects were more important in the diet of trout in the big western lakes (Corrib, Mask, Conn) than in the diet of trout in the midland lakes (Sheelin, Ennell, Owel, Derravaragh). In smaller and less productive Irish lakes, the main foods of trout were cased caddis larvae, chironomid and Chaoborus larvae, corixids,

Cladocera, emerging chironomids and terrestrial insects. The construction of two hydro-electric reservoirs on the River Lee resulted in a substantial increase in the size and rate of growth of the impounded trout in the year immediately following flooding. Because of the constant and appreciable fluctuations in water level in these reservoirs, invertebrates characteristic of the margins and shallows of natural lakes were scarce and this was reflected in the diet of the trout. Gudgeon, which for a time became very plentiful were the main food of the trout and salmon smolts were also eaten. Other important foods were chironomid larvae, corixids, Cladocera and emerging chironomids. At the mouth of streams following a rise in water level, ephemeropteran nymphs and caddis larvae often occurred in considerable numbers in trout stomachs. Elsewhere in the reservoirs, following a rise in water level, earthworms and terrestrial tipulid larvae were found in the trout. (Authors)

15044. Owen, J. M., J. W. Adron, J. R. Sargent, and C. B. Cowey (Inst. of Mar. Biochem. (NERC); Aberdeen Scotland, UK). 1972. STUDIES ON THE NUTRITION OF MARINE FLATFISH. THE EFFECT OF DIETARY FATTY-ACIDS ON THE TISSUE FATTY-ACIDS OF THE PLAICE Pleuronectes platessa. Marine Biology, 13(2): 160-166.

The ratios of polyunsaturated fatty acids in the lipids of hatchery-reared plaice [Pleuronectes platessa (L.)] maintained on a diet containing corn oil and freeze-dried cod muscle accurately reflect ratios of polyunsaturated fatty acids in the diet. Such plaice have much greater levels of triglycerides in both their livers and extrahepatic tissues than wild plaice of comparable size; the total amount of 22:6 w 3 acid in triglycerides of the two groups is, however, very similar. Transfer of experimental plaice to a fat-free diet caused a marked depletion of triglycerides from both livers and extrahepatic tissues with almost all fatty acids being reduced in amount. Addition of 12:0 and 14:0 ethyl esters (4% of each) to the fat-free diet caused some accumulation of triglycerides in extrahepatic tissues. Further addition of 18:2 w6 and 18:3 w3 acids (both at levels of 0.4%) to the diet caused an accumulation of triglycerides in the liver. These triglycerides had increased levels of saturated and monounsaturated fatty acids up to C18 but the levels of higher polyunsaturated fatty acids were not increased. There was relatively little change in the fatty acids of phospholipids throughout these experimental dietary regimes. The levels of phospholipids were constant and very similar to those of wild plaice. The results indicate: (1) plaice fed a diet relatively low in 22:6 w3 acid may accumulate relatively large amounts of triglyceride in order to store adequate amounts of 22:6 w 3 acid; (2) plaice are capable of synthesizing saturated and monounsaturated fatty acids up to C18 in the presence of dietary 12:0 and 14:0 acids; (3) 18:2 w 6 and 18:3 w 3 acids in the diet do not undergo chain elongation and further desaturation in plaice with the dietary regimes we used. (Authors)

15045. Ehrlich, K. F., and D. A. Farris (Biol. Dept., San Diego State College, San Diego, California). 1972. SOME INFLUENCES OF TEMPERATURE ON THE REARING OF THE GRUNION Leuresthes tenuis, AN ATHERINE FISH. Marine Biology, 12(4): 267-271.

Grunion Leuresthes tenuis (Ayres), an atherine fish, were reared from artificially fertilized eggs to 160 days posthatching, at temperatures from 18.0° to 25.4°C. The rearing was carried out in five 60 l rectangular containers and two hard moulded plastic pools holding 60 and 450 l. The growth rate was highly correlated with temperature at least up to metamorphosis. Thereafter, the effect of temperature on growth, within lethal limits, appeared to be lost or at least masked by other factors. At low densities, after metamorphosis, growth was proportional to the population density. Size and shape of the rearing containers also influenced the growth rate. (Authors)

15046. Dovel, William L. 1971. FISH EGGS AND LARVAE OF THE UPPER CHESAPEAKE BAY. Nat. Res. Inst., Univ. of Maryland, Special Report No. 4, 71 p.

15047. Loeffler, Clarence A. (Dept. of Zoophysiol., Umeå Univ., Umeå, Sweden). 1971. WATER EXCHANGE IN THE PIKE EGG. J. exp. Biol., 55(3): 797-811.

The amount and the rate of exchangeable water was determined in cell analogues and normally developing egg-embryos of the pike within the developmental interval from egg shedding to advanced myomere embryos using the automatic diver-balance. Comparisons between the volume of water exchanged and the percentage water content obtained by wet-dry weight determinations confirmed the view that essentially the entire water content of the whole egg - chemically treated and untreated - was exchanged with the isotopic medium. Water exchange in chemically treated eggs (= cell analogues) proceeded rapidly, in one continuous uninterrupted phase indicative of a diffusion process in the absence of a surface barrier. The pattern of water exchange in untreated eggs was distinctly different than that of the treated specimens, proceeding in a two-step manner: (1) a rapid, initial exchange of the fluid-filled perivitelline compartment (2) followed by a prolonged exchange of the egg proper which was characteristic of a diffusion process in the presence of a surface restriction to water flow. (From auth. summ.)

15048. Eddy, F. B. (Res. Unit for Comp. An. Resp., The Univ., Bristol, England). 1971. BLOOD GAS RELATIONSHIPS IN THE RAINBOW TROUT Salmo gairdneri. J. exp. Biol., 55(3): 695-711.

Oxygen dissociation curves were determined using blood from rainbow trout, acclimated for at least 3 weeks to temperatures of 6, 15 and 20°C. Carbon dioxide tensions in the range 0.3-7 mm Hg produced both the Bohr and Root effects in the blood. Increasing temperature, P_{CO_2} and hydrogen ions, whether raised individually or together, caused a decrease in blood O_2 affinity (increased value for P_{50}). Blood at low temperatures had a higher pH than blood at high temperatures. This is related to the fact that the ionization constant of water is diminished with decreasing temperature. When blood was 50% saturated and P_{CO_2} was 1 mm Hg, the pH value was 8.25 at 6°C, 7.83 at 15°C and 7.62 at 20°C. The factors influencing unloading of oxygen from the blood are discussed. To release the same amount of oxygen from blood, a greater change in carbon dioxide tension is required at 6°C than at higher temperatures. The Bohr effect expressed quantitatively ($\triangle \log P_{50}/\triangle$ pH) was -0.54 at 6°C, -0.57 at 15°C and -0.59 at 20°C. These values are similar to those for the blood of many mammals, and are within the range reported for fish, where whole blood has been used. (Auth. summ.)

15049. Holeton, G. F. (Dept. of Zool., Univ. of Bristol, England). 1971. RESPIRATORY AND CIRCULATORY RESPONSES OF RAINBOW TROUT LARVAE TO CARBON MONOXIDE AND TO HYPOXIA. J. exp. Biol., 55(3): 683-694.

Larval trout undergo a transition from cutaneous respiration to gill respiration which at 10°C is well advanced by the 18th day after hatching. Resting heart rate of newly hatched trout increases during the first few days, stabilizes for a while, and then drops between the 9th and 18th day after hatching. This drop may be the result of establishment of 'vagal tone'. The basic breathing response of larval trout when hypoxic is an increase in fin movements and an increase in rate and amplitude of breathing, but breathing movements slow and weaken if environmental P_{O_2} falls much below 40 mm Hg. With trout up to 8 days after hatching hypoxia causes a tachycardia. At very low P_{O_2} levels there is a drop in heart rate and in the amount of blood pumped by the heart. Upon restoring oxygen to very hypoxic larvae, the heart rate recovers slowly, unlike the quick abolition of bradycardia of adult fish. It appears that up to the age of 8 days from hatching, trout do not have a functional bradycardia reflex associated with hypoxia. The responses of larval trout to CO and to hypoxia, and of adult trout to CO, are similar in nature. It is proposed that the basic response to anoxaemia is an increase in breathing and circulation and that the adult bradycardia response to hypoxia is a superimposed mechanism which relates circulation to the quantity of oxygen presented to the gills. (Auth. summ.)

15050. Zaugg, W. S., B. L. Adams, and L. R. McLain (Western Fish Nutrition Lab., Bur. of Sport Fish. and Wildl., Cook, Washington). 1972. STEELHEAD MIGRATION: POTENTIAL TEMPERATURE EFFECTS AS INDICATED BY GILL ADENOSINE TRIPHOSPHATASE ACTIVITIES. Science, 176(4033): 415-416.

Yearling steelhead trout held in fresh water at cold temperatures (6.5° or 10°C) showed an increase in gill microsomal Na^+, K^+-stimulated adenosine triphosphatase activity during parr-smolt transformation, whereas trout held in warm water (15° or 20°C) did not. Adenosine triphosphatase activity increased and other indications of transformation were observed in fish transferred from warm to cold water, whereas the reverse occurred on transfer from cold to warm water. (Authors)

15051. Lanse, Roger I. 1971. THE 1970 SPORT FISH HARVEST - SHASTA RIVER, SISKIYOU COUNTY, INCLUDING THE PROPORTION OF THE ADULT STEELHEAD (Salmo gairdneri) POPULATION HARVESTED BY ANGLERS. State of Calif., The Resources Agency, Dept. of Fish and Game, Anadromous Fisheries Branch Administrative Report No. 72-1.

The study area included about 37 miles of the Main Stem Shasta River from its mouth upstream to Dwinnell Dam. The study period extended from May 2 through November 15, 1970, the legal length of the trout fishing season. A total of 6,813 angler hours was estimated to have been spent harvesting an estimated 172 adult steelhead and 8,424 juvenile steelhead. Also harvested were an estimated 600 nonsalmonid fish. Of the 8,424 juvenile steelhead kept by anglers, 33% were taken on the opening weekend, May 2 and 3, and 99% were taken during the entire month of May. Anglers harvested 20% of the adult steelhead migrating upstream past the counting station at the mouth of the Shasta River. (Auth.)

15052. Childers, W. F., P. Cho, and G. S. Whitt (Dept. of Zool., Univ. of Ill., Urbana, Illinois 61801). 1972. ISOZYME ANALYSIS OF THE GREEN SUNFISH X LARGEMOUTH BASS ♀ F_1 INTERTRIBAL HYBRID (CENTRARCHIDAE). Isozyme Bull., 5(32).

Hybridization between closely related species of sunfishes occurs quite commonly in nature. A few intergeneric hybrids have been reported; however, natural intertribal hybridization is extremely rare. A number of intertribal hybrids have been produced by mixing gametes in vitro. Eggs from a largemouth bass (Micropterus salmoides) were fertilized in vitro with sperm from green sunfish (Lepomis cyanellus), bluegill (L. macrochirus), redear sunfish (L. microlophus), and rock bass (Ambloplites rupestris). Intertribal hybrids of the first two crosses were successfully reared to 2 or more years of age. All individuals of the second two crosses died prior to becoming free-swimming fry. Of the four crosses the largemouth x green sunfish was by far the most successful and was the only cross analyzed by starch gel electrophoresis. The purpose of this investigation was to determine if both parental genomes were present and to what extent functional in the F_1 hybrid. The electrophoretic mobilities of the following enzyme systems differed for the two parental species: alpha-glycerolphosphate dehydrogenase (skeletal muscle), tetrazolium oxidase (skeletal muscle and liver), malate dehydrogenase [NAD] (skeletal muscle), lactate dehydrogenase (eye), esterases (eye, liver, and brain), 6-phosphogluconate dehydrogenase (liver, G-6 - phosphate dehydrogenase (liver), and isocitrate dehydrogenase (liver). For most of these enzymes, both parental forms were present in the F_1 hybrid; however, for a few, only one parental form was present. (Authors)

15053. Rutledge, William P. (Texas Parks and Wildl. Dept., Canyon, Texas). 1971. A CONTRIBUTION TOWARDS A BIBLIOGRAPHY OF THE WHITE CRAPPIE, Pomoxis annularis, AND THE BLACK CRAPPIE, Pomoxis nigromaculatus. Texas Pks. & Wildl. Dept., Tech. Series No. 6, pp. 15-35.

A bibliography of literature containing specific life history references to white and black crappie. (Auth.)

15054. Whitt, Gregory S., and William F. Childers (Dept. of Zool, Univ. of Ill., Urbana, Illinois). 1972. HETEROSIS IN A HYBRID SWARM OF SUNFISH. Isozyme Bulletin, 5(30).

Interspecific hybridization of sunfishes (Centrarchidae) has permitted the investigation into the molecular basis of heterosis, with respect to hemoglobin. Many of the species of sunfish are sufficiently genetically distinct to possess isozymes with different electrophoretic mobilities, yet are closely enough related to readily hybridize and produce fertile progeny. The purpose of the present investigation is to determine the extent of heterozygosity in a hybrid swarm of sunfish at three enzyme loci. The enzymes examined ware NAD dependent supernatant malate dehydrogenase, an esterase, and "tetrazolium oxidase." The F_1 hybrids (♂redear sunfish (Lepomis microlophus) x ♀ bluegill (L. macrochirus) were produced in the laboratory and then placed in a pond where they produced the F_2 and succeeding generation hybrids. Six years later 380 fish were removed from the pond and their year class and phenotype (morphological and isozymic) were determined. The expected ratio of enzyme phenotypes for each locus in the F_2 generation is 1. redear: 2 hybrid: 1 bluegill. However, of the F_2 individuals examined (236), all were heterozygous at all three enzyme loci examined. No homozygous isozyme phenotypes were observed until after the F_2 generation where succeeding generations could have been formed from any of the following matings $F_1 \times F_1$; $F_1 \times F_2$; $F_2 \times F_2$; $F_1 \times F_3$, etc. We have interpreted these results as indicating that the hybrid individual possesses a greater selective advantage than the more homozygous individuals. The striking deviation from the expected 1:2:1 F_2 ratio may reflect a general selection for heterozygosity at many loci in the F_2 generation. (Authors)

15055. Milanesi, Albert A., and John W. C. Bird (Rutgers Univ., Dept. of Physiol., Nelson Biol. Labs., New Brunswick, New Jersey). 1972. LYSOSOMAL ENZYMES IN AQUATIC SPECIES - II. DISTRIBUTION AND PARTICLE PROPERTIES OF THERMALLY ACCLIMATED MUSCLE LYSOSOMES OF RAINBOW TROUT, Salmo gairdneri. Comp. Biochem. Physiol., 41(3B): 573-591.

Subcellular particles demonstrated structure-linked latent activity and single peak optimum activity in the acid pH range. Maximum activity of each acid hydrolase at different incubation temperatures varied from one enzyme to another. At 28°C incubation temperature there was greatest stability of all the acid hydrolases. The specific activity of cytochrome oxidase was significantly higher at cold thermal regimens. After differential centrifugation the highest relative specific activity of the enzymes was always found in the light mitochondrial fraction regardless of acclimation temperature. (Authors)

15056. Milanesi, Albert A., and John W. C. Bird (Rutgers Univ., Dept. of Physiol., Nelson Biol. Labs., New Brunswick, New Jersey). 1972. LYSOSOMAL ENZYMES IN AQUATIC SPECIES - III. ZONAL CENTRIFUGATION STUDIES OF THERMALLY ACCLIMATED SKELETAL MUSCLE LYSOSOMES OF RAINBOW TROUT, Salmo gairdneri. Comp. Biochem. Physiol., 41(3B): 593-602.

Fractionation of total muscle homogenates by rate zonal centrifugation shows a slow sedimenting population peak of acid hydrolases around fraction four and a fast sedimenting population with the mitochondria against the gradient cushion. Cold and warm acclimated muscle lysosomes have a significant increase in acid hydrolase activity against the gradient cushion. Isopycnic zonal centrifugation shows that 12°C acclimated muscle lysosomes are as dense as the mitochondria having a modal equilibrium density peak at 1·18. Cold and warm acclimated muscle lysosomes have modal equilibrium densities, less dense (1·17) and more dense (1·19), respectively, than optimum acclimated muscle lysosomes. The response of warm acclimated muscle cells was the formation of autophagic vacuoles. (Authors)

15057. Rawson, Mac V., Jr., and Wilmer A. Rogers (Coop. Fish. Unit, Univ. of Ga., Athens, Georgia). 1971. A REDESCRIPTION OF Anchoradiscus triangularis (Summers, 1937) Mizelle, 1941 (TREMATODA: MONOGENEA) FROM THE BLUEGILL Lepomis macrochirus Rafinesque. Proc. Helm. Soc. Wash., 38(2): 264-266.

15058. Randall, D. J., D. Baumgarten, and M. Malyusz (Zool. Dept. Univ. of Brit. Columbia, Vancouver, Br. Columbia, Canada). 1972. THE RELATIONSHIP BETWEEN GAS AND ION TRANSFER ACROSS THE GILLS OF FISHES. Comp. Biochem. Physiol., 41(3A): 629-637.

The relationship between perfusion pressure and flow of saline through the gills of an isolated head of rainbow trout (Salmo gairdneri) was determined. Noradrenaline, adrenaline and isoprenaline decrease the vascular resistance to flow through the gills in the isolated head preparation, indicating the presence of both α- and β-adrenergic receptors in the gills. The rate of ^{22}Na loss across the gills of intact trout was determined in fish with ligated urogenital papillae. The rate of ^{22}Na loss was higher in "active" than in "quiet" fish. Adding noradrenaline or isoprenaline to the water containing the fish also increased the rate of ^{22}Na loss across the gills. The significance of these observations is discussed. (Authors)

15059. Boström, S-L., and Rolf G. Johansson (Dept. of Zoophysiol., Univ. of Göteborg, Göteborg, Sweden). 1972. EFFECTS OF PENTACHLOROPHENOL ON ENZYMES INVOLVED IN ENERGY METABOLISM IN THE LIVER OF THE EEL. Comp. Biochem. Physiol., 41(2B): 359-369.

The effects of PCP in vivo and in vitro on the activity profiles of hexokinase, glucose-6-phosphate dehydrogenase, 6-phosphogluconate dehydrogenase, pyruvate kinase, lactate dehydrogenase, fumarase and cytochrome oxidase in the liver of the eel were investigated. In vivo the activities of pyruvate kinase and lactate dehydrogenase decreased after acute PCP poisoning. On the other hand, the activities of hexokinase, glucose-6-phosphate dehydrogenase, 6-phosphogluconate dehydrogenase, fumarase and cytochrome oxidase showed increased activity. After a recovery period of 30 days in uncontaminated water the PCP-treated eels showed higher activity levels for all the investigated enzymes compared to the controls. Comparison of enzyme activity ratios in vivo suggests a shift between different metabolic pathways. In vitro PCP inhibits all the investigated enzymes. The concentration of soluble protein increased significantly after the eels had been treated with PCP. (Authors)

15060. Haider, Gerhard (Institut für Siedlungswasserbau und Wassergütewirtschaft der Universität Stuttgart). 1972. HEMATOLOGICAL OBSERVATIONS ON RAINBOW TROUT (Salmo gairdneri RICH.). V. THE DISTRIBUTION CURVE OF ERYTHROCYTES [Hämatologische Beobachtungen an Regenbogenforellen (Salmo gairdneri RICH.). V. Die Erythrozytenverteilungskurve]. Hydrobiologia, 39(2): 289-299. In German with English summary.

As differential-diagnostic feature in the fish pathology it is suggested to measure the red blood cells. The normal technique used in human medicine for plotting the distribution curve of the red blood cells is modified, because the red blood cells of the fish are of elliptical shape. One hundred and two rainbow trout (Salmo gairdneri), both male and female, and 1-3 years of age, were examined to find the normal curve for healthy animals of this population. The size distribution of the red blood cells show a bell-shaped "Gauss"-curve, the peak of which is 30-35 $\mu m^2/\pi$, and the basis of which reaches from 15-20 $\mu m^2/\pi$ to 55-60 $\mu m^2/\pi$. The Price-Jones-curves show no significant differences between the milters (52 individuals) and the spawners (50 individuals). Besides, changes caused by different age or seasonal influences could not be observed on this normal curve. Analyzed were the F2 individuals. (Auth. summ.)

15061. Burris, Kenneth Wayne, and Grover C. Miller (Zool. Dept. N. Carolina St. Univ., Raleigh, North Carolina). 1972. PARASITIC COPEPODS OF SOME FRESHWATER FISHES FROM NORTH CAROLINA. J. Elisha Mitchell sci. Soc., 88(1): 18-20.

During the summer of 1971, a study was made of the parasitic copepods found on 209 fishes representing 10 families and 28 species. Collections were made in six counties in North Carolina. Fifty-six percent of the fishes were infested with 10 species of copepods belonging to three families and three genera. Twelve new host parasite records are reported, and North Carolina represents new locality records for all 10 species of copepods. (Authors)

15062. Arnott, H. J., J. A. C. Nicol, F. R. S. and C. W. Querfeld (The Univ. of Texas Cell Res. Inst. at Austin and Mar. Sci. Inst. at Port Aransas, and the High Alt. Observatory at the Nat. Center for Atmos Res. at Boulder, Colorado). 1972. TAPETA LUCIDA IN THE EYES OF THE SEATROUT (SCIAENIDAE). Proc. roy. Soc. (B), 180(1060): 247-271.

Eyes of the seatrout (Sciaenidae) contain a tapetum lucidum, located in processes of the pigment epithelial cells. The tapetum is a white diffuse reflector, occluded by black retinal pigment by day, and exposed by retreat of pigment at night; threshold for pigment migration is around 10 lx. Reflexion is caused by backscattering of light from a multitude of small spheres, each about 0.4 μm in diameter, packing the cell processes. Material has been examined by electron microscopy, employing epoxide sections and freeze-etch techniques. The spheres have homogeneous, densely-staining contents and are surrounded by thin boundary membranes. The reflecting material is a lipid, it has been extracted, purified by column and thin-layer chromatography, and characterized by TLC and GLC. On TLC it runs at the same rate as triglycerides, and is demarcated according to class from wax esters, sterols and diacyl glyceryl ethers. It contains predominantly one fatty acid, n-C22:6 (⩾ 95%), and appears to be largely tridocosahexaenoin. The tapetum contains 1.5 mg of triglyceride per square cm. The relationship of the tapetum to the photoreceptors and some characteristics of the latter are described, and reference is made to the occurrence of similar lipid tapeta in other families of fishes. (Authors)

15063. Gordon, M. S. (Dept. of Zool. and Inst. of Evol. and Environ. Biol., Univ. of Calif., Los Angeles, California). 1972. COMPARATIVE STUDIES ON THE METABOLISM OF SHALLOW-WATER AND DEEP-SEA MARINE FISHES. I. WHITE-MUSCLE METABOLISM IN SHALLOW-WATER FISHES. Marine Biology, 13(3): 222-237.

Maximal rates of oxygen consumption in vitro have been measured under standardized conditions at three test temperatures (5°, 15°, and 25°C) on minced preparations of white muscle from 39 species of shallow-water marine teleost fishes. These fishes came from four different geographic areas, two with cool average water-temperatures (near 15°C: coastal southern California, Galápagos Islands) and two with warm average water-temperatures (near 25°C: Hawaiian Islands; Bermuda). The group includes species covering much of the range of variation to be found among the teleosts with respect to five additional variables: phylogenetic position, type of environment, body weight, activity level, and growth stage. The purpose of the work is to provide part of a base line of tissue-metabolism data on shallow-water fishes for comparison with similar results from deep-sea species. Major conclusions from statistical analyses of the results are: four groups of shapes of oxygen-uptake rate versus temperature curves exist: normal, flat, dipped and peaked. Over 50% of curves are normal. Intra-group differences, contributing significantly to the total variance of the results at given test temperatures, are: cool versus warm average environmental temperatures primarily for epipelagic species; epipelagic versus non-epipelagic environments; very active species versus all others; juvenile stages versus adults. In each case, the subgroup first mentioned shows higher muscle oxygen-uptake rates than the other subgroup. Variables not contributing significantly to the total variance are phylogenetic position and body weight. Physiological and ecological implications of these results are discussed. ((Auth.)

15064. Rodgers, Charles A., and David L. Stalling (Fish-Pesticide Res. Lab., Bur. Sport Fish. & Wildl., Columbia, Missouri). 1972. DYNAMICS OF AN ESTER OF 2,4-D IN ORGANS OF THREE FISH SPECIES. Weed Science, 20(1): 101-105.

The uptake of ^{14}C-labeled butoxyethanol ester of (2,4-dichlorophenoxy) acetic acid (BEE of 2,4-D) from water by three species of fed and fasted fish was studied. Fish were exposed to either 0.3 or 1.0 mg/L of herbicide for up to 168 hr. Combined residues of the 2,4-D ester and its metabolic products were determined radiometrically in eight tissues and organs. Extracts of these organs were examined by thin layer chromatography and autoradiography. Maximum residue concentrations were observed in most organs of fed fish within 1 to 2 hr of exposure,

and within 1 to 8 hr of exposure for fasted fish. After maximum residue concentrations were reached, the herbicide and/or its metabolites were eliminated rapidly. (Authors)

15065. Michewicz, Jane E., D. L. Sutton, and R. D. Blackburn (Univ. of Fla., Agr. Res. Center, Fort Lauderdale, Florida). THE WHITE AMUR FOR AQUATIC WEED CONTROL. Weed Science, 20(1): 106-110.

The use of herbivorous fish for the biological control of aquatic weeds has great potential. The susceptibility of most herbivorous fish to low temperature is the principal factor limiting their use in the United States. The white amur (Ctenopharyngodon idella Val.) can tolerate low temperature and other water quality extremes. This fish has a voracious appetite for many aquatic plants, and after attaining a length of 30 mm, it is almost exclusively phytophagous. Factors affecting the feeding habits of the white amur include the species of plants and water temperature. The white amur has been introduced for aquatic weed control in various countries. This fish might ameliorate some of the aquatic weed problems in the United States, and also provide a new source of protein. (Authors)

15066. Thakur, Nirmal K., Masao Takahashi, and Shiro Murachi (Dept. of Fish., Fac. of Fish. and Animal Husbandry, Hiroshima Univ., Fukuyama, Japan). 1971. OSTEOLOGY OF BLUEGILL SUNFISH, Lepomis macrochirus Rafinesque. J. Fac. Fish. Hiroshima, 10(2): 73-101. In English.

The present study was undertaken in order to provide information upon the normal skeletal structure of bluegill sunfish, Lepomis macrochirus Rafinesque, to the researchers using it as an experimental animal and to the taxonomists trying to work out the relationship between the members of the Centrarchidae family. This study is based upon the examination of 100 bluegill specimens made by cleaning, staining and roentgenography. Statistical analyses of various skeletal proportions revealed small fluctuations except for the cranium height and width which were observed to be size-dependent. Correlation between external and skeletal characters have been made to predict the position of several skeletal components on the body of fish without subjecting it to the troubles of scissors and forceps. Basic scheme of the arrangement of bones except for their shapes and sizes, has been found out to be more or less the same as that of Sacramento perch. However, reduction in the number of certain skeletal components has been observed in bluegill. A second uroneural has been discovered in bluegill which hitherto had not been reported from any other centrarchid including bluegill. Comparison of meristic measurements as stated by various authors presented some difference in the number of dorsal soft ray, trunk vertebrae, scales, and gill rakers. (Authors summ.)

15067. Nakamura, Nakaroku, Shogoro Kasahara and Toshiaki Yada (Dept. of Fish., Fac. of Fish. and Animal Husbandry, Hiroshima Univ., Fukuyama, Japan). 1971. STUDIES ON THE USEFULNESS OF THE BLUEGILL SUNFISH, Lepomis macrochirus Rafinesque, AS AN EXPERIMENTAL STANDARD ANIMAL. II. ON THE DEVELOPMENTAL STAGES AND GROWTH FROM THE EGG THROUGH ONE YEAR. J. Fac. Fish. Hiroshima, 10(2): 139-151. In Japanese with English summary.

As part of research on the usefulness of the bluegill sunfish, Lepomis macrochirus, Rafinesque, as an experimental standard animal in fisheries research, we have tried to find a way of obtaining its fingerlings throughout the year curriculum. In sequence to the previous study on the breeding habits, some examinations have been conducted mainly on the developmental stages and the growth from the egg till one year after the hatching, using eggs spawned by full three or four year old fish in rearing tanks. The egg is adhesive and spherical in shape, measuring about 1.23 mm in diameter, with one large oil-globule (ca. 0.38 mm) and many minute ones. The egg diameter varies in the individuals and also in the batches of the same fish. However, no certain relation was found between the egg diameter and the age, the size and the number of times of spawning of the mother fish nor with the number of eggs spawned. The incubation period was about 40 hours (37-43 hours) at a temperature of 24.5°C, 28 hours (27-29 hours) at 28.5°C and 79 hours (75-85 hours) at 18.5°C, respectively. However, abnormal larvae appeared

in a fairly high percentage (around 46%) at a temperature of 18.5°C, which is considered nearly out of the optimum spawning temperature. The percentage of fertilization and hatching of the eggs taken by artificial insemination was somewhat lower than that of natural spawning. The newly hatched larva is about 3.23 mm in total length, with a yolk of 1.13 x 0.9 mm in size and no pigment in any part of the body. Cladocera (Moina sp.) seems to be the most adequate food in the early stages of the bluegill larva; those fed with them showed faster growth than those fed with rotifers or copepods. The definite number of the spine and ray of each fin appeared at a total length of 13 mm, after that the lateral striped pattern appeared on the side of the body with complete formation of the scale at a size of 14-15 mm in total length. From the examination of the size-frequency of the reared fingerlings, it was recognized that the phenomenon of "shoot individual" does not occur. The first year's growth of the bluegills is about 5.3 cm (3.0-8.3 cm). The average rate of growth of the female is below that of the male. (Authors summ.)

15068. Wheat, T. E., G. S. Whitt, and W. F. Childers (Cell Biol. Program, Dept. of Zool., Univ. of Ill., Urbana, Illinois). 1972. INHERITANCE OF ISOZYMES IN HYBRID SUNFISH. Isozyme Bull., 5(31).

Backcross progeny produced from interspecific hybrid sunfish have been examined for evidence of genetic linkage, allelic repression, and heterosis. From an evolutionary viewpoint, the analysis of linkage between the supernatant malate dehydrogenase A and B loci (MDH-A and MDH-B) is particularly interesting. In a cross between a redear sunfish and an F_1 hybrid (redear sunfish x bluegill), the MDH-A and MDH-B loci underwent recombination at a frequency of 47.6% $\pm$ 6.35%. This is not significantly different from the random assortment of codominant alleles at unlinked loci. Although loose linkage cannot be excluded, it is clear that the MDH-A locus is not closely linked to the MDH-B locus in this system. This absence of linkage may be significant in light of the very close homologies between the supernatant MDHs of some fish. This absence of linkage may reflect the evolutionary mechanism which generated these duplicate loci since some other more distantly related homologous loci have remained closely linked. It has been proposed that closely linked loci arose by tandem duplication while unlinked loci were generated by polyploidization and that the latter mechanism played an important role in the earliest stages of vertebrate evolution. While our linkage data is consistent with the duplication of an ancestral supernatant MDH gene during a polyploidization event, we cannot exclude the possibility of tandem duplication followed by translocation. Additional observations on patterns of isozyme inheritance in this and other interspecific hybrid crosses will be discussed. (Authors)

15069. Lanse, Roger I. 1970. AN ESTIMATE OF ANGLER PRESSURE AND SPORT FISH HARVEST FROM THE KLAMATH RIVER BETWEEN IRON GATE DAM AND DUTCH CREEK, INCLUDING DATA DESCRIBING THE SIZE OF ANADROMOUS FISH SPAWNING MIGRATIONS. State of Calif., The Resources Agency, Dept. of Fish and Game, Anadromous Fish. Administrative Report No. 70-3.

The study area included 23.5 miles of the Klamath River in northwestern California from Iron Gate Dam downstream to the confluence of Dutch Creek. The study period extended from September 1, 1967, through August 31, 1968. A total of 58,379 angler hours were estimated to have been spent harvesting an estimated 6,710 adult steelhead, 20,002 juvenile steelhead, 314 adult king salmon, 46 juvenile king salmon, and 345 juvenile silver salmon. Also harvested were 1,958 non-salmonids. Anglers harvested approximately 32 percent of the adult steelhead entering the study area (estimated 6,710 of 20,841) and about two percent of the adult king salmon entering the study area in the fall of 1967 (estimated 278 of 16,909). Of 25,688 juvenile steelhead released into the Klamath River on May 6, 1968, from Iron Gate Hatchery, 2,869, or 11 percent, were harvested by anglers within the study area. (Auth. summ.)

15070. Wunder, W. (Zool. Inst. der Univ. Erlangen, Germany). 1971. RESISTANCE AND DEFENSE REACTIONS OF OLDER RAINBOW TROUT AGAINST LIVER CANCER (HEPATOMA) CAUSED BY AFLATOXINS [Widerstandsfähigkeit und Abwehreinrichtungen des Fischkörpers bei älteren Regenbogenforellen gegen Leberkrebs (Hepatoma) verursacht durch Aflatoxine]. Archiv für Fischereiwissenschaft, 22(1): 51-64. In German with English summary.

In 1968, 1969, 1970 observations were made on hepatoma in rainbow trout at 20 different fishfarms in Western Germany. One hundred and fifty large rainbow trout with cancer were collected. Young immature spawners (1 kg in weight) are very susceptible to cancer in both sexes. In two instances, the loss resulting from cancer was 60% and 80%. Males and females became ill in the same proportion. Large mature males (weight 2 kg) were completely resistant. Large mature females (2 kg in weight) became ill in low percentage (1-5%). Nearly 50% of the ill mature females showed defensive reaction against cancer; expressly, regeneration and superregeneration of the liver, building of a connective tissue cover over the tumor surface and the development of blood vessels on the surface of the tumor to bring leucocytes to the tumor and to remove necrotic cells and their products from the tumor. Destruction of the cancer cells has been caused by blood coagulation (hematoma), suppuration and secernation of water fluid with lymphocysts. There can be demonstrated a degeneration of the tumor to a cyst filled with watery fluid without any cancer cells. The rainbow trout seems to be a very good experimental subject in regard to liver cancer. It may be possible to treat the sick animal by injecting its own blood into the tumor to destroy the cancer cells. One could experiment with castration or with different sex hormones. Of course, the results of such experiments on rainbow trout cannot be transferred directly to other animals and man. Different animals have different reactions to carcinogens. Certain species, such as the rainbow trout, are very sensitive to carcinogens; the brown trout is not. There are carcinogens belonging to certain organs - the liver of the rainbow trout is very sensitive. There are certain general rules concerning animals and man. Every enlargement of our knowledge in this field may be very important later in combating human cancer. (Auth. summ.)

15071. Suzuki, Keiko, and Bun-ichi Tamaoki (Nat. Inst. of Radiol. Sci., Anagawa-4-chome, Chiba-shi 280, Japan). 1972. SPECIFICITY OF STEROID 11β-HYDROXYLASE IN TESTES OF RAINBOW TROUT (Salmo gairdneri). General and Comparative Endocrinology, 18(2): 319-328.

Subcellular fractions of testes of rainbow trout (Salmo gairdneri) were prepared by a differential centrifugation, examined under an electron microscope, and incubated with 4-^{14}C-labeled androstenedione, testosterone, 11-deoxycorticosterone, or 11-deoxycortisol at 16°C for 60 min under an aerobic condition. After identification of the metabolites obtained, activities of 11β-hydroxylase, 17α-hydroxylase, and 17β-hydroxysteroid dehydrogenase per unit weight of protein were estimated from the quantities of the metabolites. Among the subcellular fractions, the activity of 11β-hydroxylase upon testosterone, 11-deoxycorticosterone, and 11-deoxycorticosterone and 17β-hydroxysteroid dehydrogenase upon androstenedione and testosterone were localized mostly in the microsomal fraction. Moreover, the 11β-hydroxylase in the rainbow trout testes preferred 11-deoxycorticosterone most and 11-deoxycortisol next as the substrate, whereas testosterone was hydroxylated at 11β-position in low yield and androstenedione was not. By raising incubation temperature from 16°C to 37°C, 11β-hydroxylation of testosterone was not enhanced at all, while the 17β-hydroxysteroid dehydrogenase activity was increased more than two times as much as the activity at 16°C. From the results obtained, the biosynthetic pathway of 11-oxygenated androgens in the teleostean testes were discussed. (Authors)

15072. Minckley, W. L. (Dept. of Zool., Arizona State Univ., Tempe, Arizona). 1972. NOTES ON THE SPAWNING BEHAVIOR OF RED SHINER, INTRODUCED INTO BURRO CREEK, ARIZONA. The Southwestern Naturalist, 17(1): 101-103.

15073. Luquet, P. (Central Nutr. Res. Sta., National Center of Zootechnical Research, I.N.R.A., 78-Jouy-en-Josas, France). 1971. EFFICIENCY OF PROTEINS IN RELATION TO THEIR RATE OF INCORPORATION IN THE FEED OF THE RAINBOW TROUT (Efficacite des Proteines en Relation Avec Leur Taux d'Incorporation dans l'Alimentation de la Truite Arc-en-Ciel). Annales d'Hydrobiologie, 2(2): 175-186. In French with English summary.

Four semi-synthetic diets, based on herring meal and raw maize starch and containing 30 to 60 p. 100 protein, were given ad libitum to 4 groups of rainbow trout for 36 weeks. The body weight and composition, amount of food consumed, and the utilization of protein were studied. The following results have been obtained: the rate of growth was identical for each group, the trout showed a weight gain of 200 g in 36 weeks; the average daily weight gain was, on an average, 0.3 g between 0 and 6 weeks, 0.6 g between 6 and 13 weeks, 0.8 g between 13 and 21 weeks and 1 g after 100 g; there was a greater amount of fat at the end of the experimental period in the fish receiving 50 and 60 p. 100 protein; the appetite of the fish on the different diets was the same; there is little difference between the conversion factor, they are 1.64, 1.65, 1.54 and 1.71 for the diets containing 30, 40, 50, and 60 p. 100 protein respectively; the protein efficiency ratio increases from 0.98 to 2 when the protein content of the diet changes from 60 to 30 p. 100. The maximum value of this coefficient has not been observed. It may be concluded from these results that, under the prevailing experimental conditions, part of the proteins is used for energy, and that the protein requirements of trout are less than 30 p. 100 of the dry matter. (Auth. summ.)

15074. Gee, John H. (Dept. of Zool., Univ. of Man., Winnipeg 19, Manitoba, Canada). 1972. ADAPTIVE VARIATION IN SWIMBLADDER LENGTH AND VOLUME IN DACE, GENUS Rhinichthys. J. Fish. Res. Bd. Canada, 29(2): 119-127.

Relative growth in length and volume of swimbladder is described in four species of dace, genus Rhinichthys. Swimbladder volume varied widely in R. atratulus, R. cataractae, and R. osculus as they adjusted buoyancy by altering swimbladder volume, but variability was less in R. falcatus whose range was overlapped by the other three species. A variety of relative growth patterns in swimbladder length was found due mainly to the presence or absence of an inflection which, when present, varied at fork length of occurrence. Where ecological information was known, the length at occurrence of inflection corresponded to a change in environment occupied, from still to current. In the laboratory, R. atratulus and R. cataractae adjusted swimbladder volume to compensate for different water velocities. All age-groups of the former attained a greater buoyancy than the latter, while R. cataractae reached a lower negative buoyancy. Young R. cataractae made greater adjustments of swimbladder volume than older fish; the reverse occurred with R. atratulus. These adjustments resulted in a significant change in swimbladder length independent of age, except for R. cataractae from Lake Winnipeg which had very short swimbladders. The hypothesis that occurrence of the inflection in swimbladder length was caused by the shift from a still to current environment, resulting in a decrease in swimbladder volume and length was accepted for R. atratulus, but rejected for R. cataractae. An additional hypothesis based on environmental control is proposed. (Auth.)

15075. Nyman, O. L., and J. H. C. Pippy (Fish. Res. Bd. of Canada Biol. Sta., St. John's, Newfoundland, Canada). 1972. DIFFERENCES IN ATLANTIC SALMON, Salmo salar, FROM NORTH AMERICA AND EUROPE. J. Fish. Res. Bd. Canada, 29(2): 179-185.

Differences in electropherograms produced by serum proteins and liver esterases were used to identify North American and European Atlantic salmon (Salmo salar) caught at sea. Division of salmon according to continent of origin was supported by mean river age, mean fork length, and abundance of the two parasites Anisakis simplex and Eubothrium crassum. Consistent differences in electrophoretic behaviour of serum proteins and liver esterases in salmon from the two continents support the suggestion that salmon from North America and Europe represent different subspecies. (Authors)

15076. Fraser, J. M. (Ont. Dept. of Lands and Forests Res. Branch, Maple, Ontario, Canada). 1972. RECOVERY OF PLANTED BROOK TROUT, SPLAKE, AND RAINBOW TROUT FROM SELECTED ONTARIO LAKES. J. Fish. Res. Bd. Canada, 29(2): 129-142.

Recoveries of hatchery-reared brook trout (Salvelinus fontinalis), splake (Salvelinus namaycush X S. fontinalis), and rainbow trout (Salmo gairdneri), planted in lakes having different resident fishes, were highest (9-30%) in a lake in which minnows and the brook stickleback were the only other fishes. Recoveries, by angling and gillnetting, were considerably lower (2-15%) in two lakes containing the white sucker and minnows, and still lower (0.5-5%) in two lakes containing spiny-rayed species as well. Recoveries were lowest (< 0.5%) in a lake having a complex fish community that included native brook and lake trout. Planted splake and rainbow trout generally yielded higher returns, in weight, than brook trout in comparable situations. The low survival of planted fish was apparently due to the low fertility of the waters and to competition with, or predation by, resident fish species. Predation by fish-eating birds and mammals may also have had an effect. The weight of the catch of salmonids exceeded the weight planted in only one lake. Here, the mean yield of planted salmonids was 8.4 kg/ha per year in comparison with 2.6 to < 0.5 kg/ha per year in the five other study lakes. (Auth.)

15077. Wolf, Ken, Roger L. Herman, and C. P. Carlson (Bur. of Sport Fish. and Wildl., Eastern Fish Disease Lab., Kearneysville, West Virginia 25430). 1972. FISH VIRUSES: HISTOPATHOLOGIC CHANGES ASSOCIATED WITH EXPERIMENTAL CHANNEL CATFISH VIRUS DISEASE. J. Fish. Res. Bd. Canada, 29(2): 149-150, illus.

A histologic examination was carried out on fry with experimentally induced channel catfish virus disease (CCVD). The infection produced a hemorrhagic and necrotic disease with the target organs being the kidneys, liver, digestive tract, and skeletal muscle. The results agree with symptoms of the disease and with published data on quantifications of virus in specific organs. (Authors)

15078. Clarke, W. Craig, and H. D. Smith (Fish. Res. Bd. of Canada Biol. Sta., Nanaimo, British Columbia, Canada). 1972. OBSERVATIONS ON THE MIGRATION OF SOCKEYE SALMON FRY (Oncorhynchus nerka) IN THE LOWER BABINE RIVER. J. Fish. Res. Bd. Canada, 29(2): 151-159.

No distinct length, weight, or behavioral differences associated with place of capture in the river were observed, indicating that all fry are susceptible to downstream displacement. A minimum of 7.5 million (18%) of the fry produced passed through a counting fence below the spawning grounds. Others reached quiet waters inshore, where they progressively developed behavioral characteristics that enabled them to ascend the river and reach lake nursery areas above. Two million fry ascended an improvised ladder spanning an area of turbulence at the base of the fence. Construction of leads and baffles at strategic places below the fence could help fry reach shore sooner and increase numbers reaching the lake. (Authors)

15079. Gilderhus, Philip A. (U. S. Fish & Wildl. Serv., Fish Control Lab., La Crosse, Wisconsin 54601). 1972. EXPOSURE TIMES NECESSARY FOR ANTIMYCIN AND ROTENONE TO ELIMINATE CERTAIN FRESHWATER FISH. J. Fish. Res. Bd. Canada, 29(2): 199-202.

In laboratory flowing-water troughs exposure required to induce 100% mortality, regardless of time to death for antimycin and rotenone against selected freshwater fish species was determined. Carp and white suckers required shorter exposures to antimycin (6 hr) than to rotenone (18-24 hr) at field-use concentrations of 5 and 50 ppb respectively. Bullheads were killed by 3-10 hr exposure to 100-250 ppb rotenone at 17 C or higher. However, the long exposure time necessary in colder water (25 hr at 100 ppb in 12 C water) made elimination of bullheads with rotenone difficult in cold seasons. Exposure time was influenced more by water temperature than by the toxicant concentration. The effects of rotenone were often reversible even after fish had been on their sides in the toxicant solution for 4-5 hr but irreversible for antimycin after fish showed the first signs of distress. (Auth.)

15080. Zaugg, W. S., and L. R. McLain (Western Fish Nutr. Lab., Bur. Sport Fish. & Wildl., Cook, Washington 98605). 1972. CHANGES IN GILL ADENOSINETRIPHOSPHATASE ACTIVITY ASSOCIATED WITH PARR-SMOLT TRANSFORMATION IN STEELHEAD TROUT, COHO, AND SPRING CHINOOK SALMON. J. Fish. Res. Bd. Canada, 29(2): 167-171.

The average Na^+- and K^+-stimulated adenosinetriphosphatase (ATPase) activity of microsomes from gills of hatchery-reared coho salmon (Oncorhynchus kisutch) increased from about 12 μmoles ATP hydrolyzed/mg protein per hr during February through mid-April to approximately 24 in mid-May. Larger fish developed higher activities than smaller fish. Hatchery-reared spring chinook salmon (O. tshawytscha) exhibited a similar increase 2-3 weeks earlier. In 2-year-old hatchery-reared steelhead trout (Salmo gairdneri), Na^+-, K^+-ATPase activities were elevated in some, but not all, smolt-appearing animals. Parr-appearing fish, including maturing males, showed no activity increase. When held in fresh water to July, steelhead smolts lost their silvery color and became more parr-like in appearance, and the previously elevated ATPase activity decreased to near pre-smolt levels. Yearling steelhead held at the laboratory showed a more consistent rise in ATPase activity. The increase in transport ATPase (Na^+-, K^+-stimulated) activity occurring during parr-smolt transformation is probably a preparatory step for saltwater adaption and may also be closely associated with migratory disposition. (Authors)

15081. Fujihara, M. P., and F. P. Hungate (Biol. Dept., Pacific Northwest Labs., Battelle Mem. Inst., Richland, Washington 99352). 1972. SEASONAL DISTRIBUTION OF Chondrococcus columnaris INFECTION IN RIVER FISHES AS DETERMINED BY SPECIFIC AGGLUTININS. J. Fish. Res. Bd. Canada, 29(2): 173-178.

River fish populations infected with Chondrococcus columnaris disease were surveyed by measurements of C. columnaris agglutinating antibodies in blood sera of fishes and by isolation of the pathogen using microbiological plating methods. Agglutinins were demonstrated in all 13 fish species collected except whitefish (Prosopium williamsoni). Blood serum from samples of fishes at four Columbia River sites during 1965 and three Columbia River sites and one Snake River site during 1969-70 demonstrated single annual cycles of C. columnaris antibody production. During the two annual sampling periods, the magnitude of antibody titers and frequency of fish with agglutinins increased in warm water and declined in cool water. The rise in titers occurred after a winter low, and usually followed the period when the first C. columnaris organisms were isolated from native fish. Agglutinating titers up to 1:5000 were found but most peak titers were between 1:320 and 1:640. (Authors)

15082. Healey, M. C. (Univ. of Aberdeen, Culterty Field Sta., Scotland). 1972. BIOENERGETICS OF A SAND GOBY (Gobius minutus) POPULATION. J. Fish. Res. Bd. Canada, 29(2): 187-194.

This paper described utilization of ingested energy by a population of sand gobies (Gobius minutus) in the Ythan estuary, Scotland, from November 1966 to March 1969. After metamorphosis (July) the gobies survived about 22 months, and their life could be divided into five stages: somatic growth (July-November); gonad growth (November-February); reproduction (February-June); more somatic growth (June-October); and further gonad growth (October-December). I calculated energy budgets for each stage from the relation: $0.8I = M + G$ where: I = ingested calories; M = calories of metabolism; G = calories of growth. Since I had measures of ingestion, growth, and routine oxygen consumption, I hoped to predict active metabolism by the energy ingested not accounted for in growth and routine metabolism. In fact, $0.8I$ either equalled the sum of growth and routine metabolism or was much too little to explain predicted expenditures for these parameters. Analysis of published feeding and growth studies in fish indicated that energy imbalances of this sort at low rations are general and that fish seem able to shunt more energy into growth when on a restricted ration than one would predict from studies of standard oxygen consumption. This result together with earlier analyses of Paloheimo and Dickie (1966) indicate that energy budgets for natural populations not based on accurate natural ingestion rates are at best only crude approximations. (Auth.)

15083. Cullimore, D. R., and A. McCann (Dept. of Biol., Univ. of Saskatchewan, Regina Campus, Regina, Saskatchewan, Canada). 1972. INITIAL STUDIES ON A METHOD OF ALGAL ASSAY FOR NUTRIENT PARAMETERS IN WATER. J. Fish. Res. Bd. Canada, 29(2): 195-198.

A bioassay technique was outlined for estimating the impact of supplementation of the nutrients carbon, nitrogen, and phosphorus on algal growth. One of the main problems was the monitoring of algal growth using lengthy techniques of chlorophyll extraction with acetone. An alternative system involving filtration and reflectometric readings at 600 nm is described and found to be satisfactory when five readings were taken per filtered disk. (Authors)

15084. Stevens, E. Don (Dept. of Zool., Univ. of Hawaii, Honolulu, Hawaii). 1972. CHANGE IN BODY WEIGHT CAUSED BY HANDLING AND EXERCISE IN FISH. J. Fish. Res. Bd. Canada, 29(2): 202-203.

Either handling or exercise cause an increase in body weight in fish acclimated to fresh water, and a decrease in body weight in fish acclimated to sea water. (Auth.)

15085. Anderson, Douglas P. (Bur. of Sport Fish. & Wildl., Western Fish Disease Lab., Seattle, Washington 98115). 1972. VIRULENCE AND PERSISTENCE OF ROUGH AND SMOOTH FORMS OF Aeromonas salmonicida INOCULATED INTO COHO SALMON (Oncorhynchus kisutch). J. Fish. Res. Bd. Canada, 29(2): 204-206.

Virulent isolates of Aeromonas salmonicida showed a majority of smooth colonies, while the attenuated isolates displayed mostly rough colonies. A lesion occurred at the site of inoculation when one of the rough forms was inoculated into yearling coho salmon, but few mortalities were recorded even though the rough forms were readily recovered from both the lesion and the kidney. The fish inoculated with the same dosage of smooth forms all died within 96 hr of inoculation. (Auth.)

15086. Kennedy, W. A. (Fish. Res. Bd. of Canada, Biol. Sta., Nanaimo, Brit. Columbia, Canada). 1972. PRELIMINARY STUDY OF SABLEFISH CULTURE, A POTENTIAL NEW INDUSTRY. J. Fish. Res. Bd. Canada, 29(2): 207-210.

A new industry may be possible based on capture of second-year juvenile sablefish (Anoplopoma fimbria) weighing about 300 g then rearing them to 4 kg for sale. I found sablefish easy to rear. Under growth-favouring conditions they gained about 150 g per fish per month, used about 5 kg wet weight of feed per kilogram gained, and had mortalities of less than 1% per month. Concentrations of at least 43 kg of fish/m^2 or 70 g/liter did not adversely affect growth or mortality. (Auth.)

15087. Lewis, D. H., and N. L. Savage (Dept. of Vet. Microbiol., Texas A&M Univ., College Station, Texas 77843). 1972. DETECTION OF ANTIBODIES TO Aeromonas liquefaciens IN FISH BY AN INDIRECT FLUORESCENT ANTIBODY TECHNIQUE. J. Fish. Res. Bd. Canada, 29(2): 211-212.

A technique for detecting antibodies in fish is described that may be of value in screening fish populations for various disease agents. The technique is based on the reaction between fluorescein-labelled antifish globulin and a fish antibody-antigen complex. The immune responses of Pimephales promelas, Notemigonus crysoleucas, and Fundulus grandis to Aeromonas liquefaciens were demonstrated by the technique. (Authors)

15088. Fowler, Laurie G. (Bur. Sport Fish. & Wild., Salmon-Cultural Lab., Longview, Washington 98632). 1972. GROWTH AND MORTALITY OF FINGERLING CHINOOK SALMON AS AFFECTED BY EGG SIZE. Progr. Fish Cult., 34(2): 66-69.

Tests with eggs from adult fall chinook salmon (Oncorhynchus tshawytscha) indicated that fry hatched from large eggs were larger than fry hatched from small eggs, and generally the fry and fingerlings maintained their size advantage during the early stages of rearing. Total mortality rates of eggs, fry, and fingerlings were higher in groups originating from large eggs than in groups originating from small eggs. (Auth.)

15089. Hanson, Lee H. (Hammond Bay Biol. Sta., Millersburg, Michigan 49759). 1972. AN EVALUATION OF SELECTED MARKS AND TAGS FOR MARKING RECENTLY METAMORPHOSED SEA LAMPREYS. Progr. Fish Cult., 34(2): 70-75.

A suitable method for marking recently metamorphosed sea lampreys is essential for understanding the population dynamics and determining the length of parasitic life, growth rates, and migratory patterns of adult sea lampreys in the Great Lakes. Such a mark should not encumber the lamprey, but must persist and be easily recognizable on full-grown, sexually mature adults. Polyvinyl chloride loop tags, disc tags, thermal branding, fin cutting, microtags, and the injection of various dye-gel and dye-solvent combinations were all tested and evaluated as potential marking techniques. I determined that a fin-injection technique, using certain dye-gel or dye-solvent combinations, was an excellent method for marking sea lampreys. All other methods evaluated were found to be unsatisfactory. (Auth.)

15090. Greenland, Donald C., and Robert L. Gill (National Mar. Fish. Serv., Rohwer, Arkansas 71666). 1972. DEVELOPMENT AND OPERATION EFFICIENCY OF A CATFISH GRADER. Progr. Fish Cult., 34(2): 76-80.

A grader to sort process-sized channel catfish (Ictalurus punctatus) was developed and tested. The unit was constructed of 8-ft-long horizontal bars having 1.75 in. clear spacing. These bars were suspended 2 to 3 in. under the water surface. Fish were dumped onto one end of the grader. Smaller fish maneuvered between the bars and removed themselves from the population. Larger fish swam the length of the grader searching for an escape route and passed off the end. The addition of diverters installed at right angles to the grader bars caused larger fish to pass through the grader. Grading error was determined in vat tests and the minimum error, 15%, occurred when separating out fish 0.9 lb. and larger. Fish size could be manipulated by changing bar spacing and adding the diverters. (Authors)

15091. Hunn, Joseph B. (Bur. Sport Fish. & Wildl., Fish Control Lab., La Crosse, Wisconsin 54601). 1972. THE EFFECTS OF EXPOSURE TO THANITE ON THE BLOOD CHEMISTRY OF CARP. Progr. Fish Cult., 34(2): 81-84.

Groups of five fish each were exposed to 3 ppm of isobornyl thiocyanoacetate (Thanite) in well water at 12° C. for 6, 8, or 12 hr. Plasma concentrations of Na, K, Ca, Mg, inorganic pO_4, lactic acid, and glucose increased with length of exposure while plasma total CO_2 and whole blood pH declined. Parameters showing the greatest change from control were plasma glucose, lactic acid, total CO_2, and the whole blood pH. Four additional groups of fish were exposed for 12 hr and then allowed to recover in fresh water for 1, 3, 8, or 10 hours. Recovery was rapid and all fish were active and appeared normal in 8 to 10 hr. Most blood chemistry parameters returned to about control values with the exception of plasma glucose which was about the same at 10 hr of recovery as after 12-hr exposure. (Auth.)

15092. Bennett, David H. (Savannah River Ecology Lab., Aiken, South Carolina). 1972. LENGTH-WEIGHT RELATIONSHIPS AND CONDITION FACTORS OF FISHES FROM A SOUTH CAROLINA RESERVOIR RECEIVING THERMAL EFFLUENT. Progr. Fish Cult., 34(2): 85-87.

Length-weight relationships and coefficients of condition were compared for bluegill (Lepomis macrochirus) and black crappie (Pomoxis nigromaculatus) collected at the entrance of a thermal effluent into a South Carolina reservoir with those from another part of the reservoir at ambient temperatures. Black crappies from the heated station were significantly heavier and of better body condition than crappies living at ambient temperatures. Fingerling bluegills at the heated station exhibited significantly lower condition factors than those from the control stations. Thermal effluents will not necessarily alter the body condition of fishes living in receiving waters provided cooler refuge sites are available. (Auth.)

15093. Goncharov, G. D., L. A. Zubkova, and M. A. Stepanova. 1970. A MONOLAYER CELL CULTURE OF BREAM KIDNEY TISSUE (Odnosloĭnaya Kletochnaya Kul'tura Pochechnoĭ Tkani Leshcha). Biologiya Vnutrennikh Vod, Informatsionnyĭ Byulleten', No. 6, AS USSR, "Nauka", Leningrad, pp. 60-64. Translated by Robert M. Howland.

15094. Clary, James Robert (U. S. Air Force Acad., Colorado Springs, Colo.). 1972. PREDATION ON THE BROWN TROUT BY THE SLIMY SCULPIN. Progr. Fish Cult., 34(2): 91-95.

On the basis of aquarium and exclosure studies it is shown that slimy sculpins (Cottus cognatus) prey on hatching brown trout (Salmo trutta) eggs and represent a potentially significant factor in their mortality. Predation on young brown trout was a function of sculpin size. These results demonstrate the importance of sculpin predation to trout populations.

15095. Gibbons, J. Whitfield, James T. Hook, and David L. Forney (Savannah River Ecol. Lab., Aiken, South Carolina 29801). 1972. WINTER RESPONSES OF LARGEMOUTH BASS TO HEATED EFFLUENT FROM A NUCLEAR REACTOR. Progr. Fish Cult., 34(2): 88-90.

Catch-effort in a systematic casting study was combined with underwater diving to determine apparent abundance of largemouth bass (Micropterus salmoides) in the vicinity of a thermal effluent into a reservoir during the winter. More fish were seen and caught when the effluent was heated than when the effluent was at ambient temperatures. Catch-effort and underwater sightings were consistently higher under the elevated temperature conditions when compared to a similar, but unheated, part of the reservoir. (Authors)

15096. Cheshire, W. F., and K. L. Steele (Ont. Dept. of Lands and Forests, Tweed, Ontario, Canada). 1972. HATCHERY REARING OF WALLEYES USING ARTIFICIAL FOOD. Progr. Fish Cult., 34(2): 96-99.

Walleye have been pond reared experimentally at the White Lake Rearing Station in Ontario since 1961. Tests were started in 1965 to determine whether young walleye would feed on an artificial diet, and thus reduce the problem of cannibalism in the ponds. Since 1969, all walleye reared have been trained to feed on trout granules. The method consists of first incubating walleye eggs in standard hatchery jars until the fry hatch. The fry are then transferred to fertilized ponds where the fish are reared to about 50 mm in length. At this stage they are transferred to troughs and raceways where they are trained to feed on trout granules. Young walleye are currently trough reared until they reach about 100 mm. Compared to pond rearing walleye to 100 mm, survival to this size can be improved by at least 6 fold by incorporating the trough rearing phase in the rearing method. (Auth.)

15097. Stickney, Robert R., Takeshi Murai, and George O. Gibbons (Skidaway Inst. of Oceanogr., Savannah, Georgia 31406). 1972. REARING CHANNEL CATFISH UNDER INTENSIVE CULTURE CONDITIONS. Progr. Fish Cult., 34(2): 100-102.

Data obtained from rearing channel catfish (Ictalurus punctatus) fingerlings at three stocking densities under intensive tank culture conditions indicated that a stocking density which will yield approximately 1 lb/cf when the fish reach an average weight of 1/2 oz is desirable. A higher density (1.5 lb/cf) resulted in considerably reduced growth rates, whereas growth rates at a lower density (0.5 lb/cf) were not substantially more rapid than that of fish reared to 1 lb/cf, until the desired maximum densities were approached. (Authors)

15098. Yoder, Warren G. (Mich. Dept. of Natural Resources, Grayling, Michigan 49738). 1972. THE SPREAD OF Myxosoma cerebralis INTO NATIVE TROUT POPULATIONS IN MICHIGAN. Progr. Fish Cult., 34(2): 103-106.

Whirling disease of salmonids, caused by Myxosoma cerebralis, was discovered in north-central Michigan in 1968. Examinations of trout 2 yr later revealed that this disease has spread from infected rainbow trout (Salmo gairdneri) in the hatchery to native brook trout (Salvelinus fontinalis) and brown trout (Salmo trutta). These infected native trout were collected from the 6 to 7 mi of stream below the contaminated source. Brook trout had a higher incidence of whirling disease than did the brown trout, although both species were in nearly equal abundance. (Auth.)

15099. Heidinger, Roy C., and William M. Lewis (Fish. Res. Lab., Southern Ill. Univ., Carbondale, Illinois 62901). 1972. POTENTIALS OF THE REDEAR SUNFISH X GREEN SUNFISH HYBRID IN POND MANAGEMENT. Progr. Fish Cult., 34(2): 107-109.

Populations of the redear sunfish (Lepomis microlophus) x green sunfish (L. cyanellus) F_1 hybrid were produced both by stocking F_1 fish and by stocking male redear sunfish and female green sunfish in farm ponds. The F_1 fish, stocked at 1,000 per acre, attained weights of 0.6 and 0.7 lb by the end of their third summer. No F_2 fish were observed to have survived. In ponds in which parental fish were stocked, F_1 fish were produced each year. No backcrosses and no F_2 fish were observed to have been produced. The first year class of F_1 fish attained a weight of 0.4 to 0.5 lb by the end of the third summer. Largemouth bass (Micropterus salmoides) populations were produced along with the hybrid populations by stocking fingerling fish at the end of the summer following the spawn of the parental sunfish or introduction of F_1 fish. (Authors)

15100. Peterson, Donald A. (Wyoming Game and Fish Comm., Wigwam Fish Rearing Sta., Ten Sleep, Wyoming 82442). 1972. BAROMETRIC PRESSURE AND ITS EFFECT ON SPAWNING ACTIVITIES OF RAINBOW TROUT. Progr. Fish Cult., 34(2): 110-112.

The evaluation of data collected over a 3-yr spawning period and statistical analyses strongly suggest that a low barometric pressure or a decrease in barometric pressure increased the spawning activity of rainbow trout (Salmo gairdneri). There was very little correlation between water temperature and light (cloud cover) in relation to spawning activity during this investigation.

15101. Brauhn, James L., and James W. Hogan (Fish-Pesticide Res. Lab., Columbia, Missouri 65201). 1972. USE OF COLD BRANDS ON CHANNEL CATFISH. Progr. Fish Cult., 34(2): p. 112.

Liquid nitrogen was used to cool silver-tipped branding tools for marking individual adult channel catfish (Ictalurus punctatus). Mark retention was excellent for 60 days. Legibility decreased thereafter until some types of numerals could not be identified at 120 days after branding. The technique is most useful for short-term research, but simple marks could be applied for population studies up to 365 days in length. (Authors)

15102. Smigielski, Alphonse S., and C. R. Arnold (NMFS, Narragansett Sport Fisheries Marine Lab., Narragansett, Rhode Island 02882). 1972. SEPARATING AND INCUBATING WINTER FLOUNDER EGGS. Progr. Fish Cult., 34(2): 113.

An even layer of flounder (Pseudopleuronectes americanus eggs was deposited on the bottom of a polyethylene dishpan, 35 by 30 by 14 cm. After the eggs were fertilized, a dense suspension of diatomaceous earth (50 g/l) was mixed with the eggs to coat them. The eggs were then poured into a dishpan converted into an incubation basket and placed in a trough with running water. The addition of diatomaceous earth, the large bottom surface area, and the smoothness of the polyethylene pan reduced clumping and increased the chances of successful egg incubation.

15103. Taber, Charles A. (Southwest Missouri State Coll., Springfield, Missouri). 1972. THE YELLOW GRUB IN CENTRARCHIDS OF SOUTHWEST MISSOURI STREAMS. Progr. Fish Cult., 34(2): 119.

The centrarchids of Southwest Missouri streams were examined for parasitism by the metacercaria or yellow grub of Clinostomum marginatum. A total of 203 specimens were autopsied. The spotted bass was most heavily infected with 32 grubs per fish and 68% of the fishes infected. Infections of others were as follows: smallmouth bass, 88% infected and 7.74 grubs per fish; largemouth bass, 56% infected and 2.09 grubs per fish; rockbass, 51% infected and 1.71 grubs per fish; bluegill, 37% infected and 1.63 grubs per fish. White crappie and green sunfish were found to be free of this parasite. Most cysts were found in the trunk muscle but the gills were also heavily infected. (Auth.)

15104. Heitmuller, Paul T., and DelWayne R. Nimmo (Environ. Protection Agency, Sabine Island, Gulf Breeze, Florida 32561). 1972. A CAGE FOR EXPOSING AQUATIC ANIMALS TO BOTTOM SEDIMENTS. Progr. Fish Cult., 34(2): p. 120.

A holding cage was constructed to assess uptake of organic pollutants from estuarine bottom sediments by penaeid shrimp in the field. The cage was a two-tier redwood frame covered with hardware cloth and weighted to give it stability in tidal currents encountered in Escambia Bay, Fla. The design features a chamber where control animals are held above while experimental animals are in direct contact with the bottom sediments. Thirty 3-in. shrimp were successfully held in one of these cages for 3 wk. (Authors)

15105. Stern, Daniel H., and Michele S. Stern (Biol. Dept., Univ. of Missouri-Kansas City, Kansas City, Missouri). 1972. LIMNOLOGICAL STUDIES OF LAKE JACOMO, JACKSON COUNTY, MISSOURI. I. WATER QUALITY AND SURFACE PLANKTON, 1970-1971. Completion Report, A-041-MO, Missouri Water Resources Research Center, Columbia, 62 p.

Water quality and surface plankton in Lake Jacomo, the primary recreational water for Kanaas City, were studied synoptically from June 1970 through May 1971. The lake, which has 2 million visitors per year, has been culturally eutrophicated by nutrient-rich runoff from watershed land containing farms, feedlots, and urban areas. Nuisance blooms are promoted by its dissected shoreline and relatively small size. Ammonia nitrogen concentrations ranged from 0.25 ppm to 2.64 ppm, nitrate nitrogen from 0.02 ppm to 1.0 ppm, and orthophosphate from 0.02 ppm to 1.79 ppm. One-hundred and eighty plankton taxa were identified. Cyanophyta, in particular Aphanizomenon flos-aquae, were dominant, except in June and from mid-November through January when Chrysophyta dominated the plankton. Recommendations from this study include the following: (1) Purchase or zoning control of the lake's watershed; (2) lake bank stabilization by the Park Department; (3) encouragement of appropriate powerboat operation to minimize wakes along unstable banks; (4) reduction of nutrient-rich runoff from agribusinesses; (5) erosion control by wise construction and farming practices; (6) reduction of blue-green algae by repeated applications of copper sulfate or copper-containing algicides; and (7) limited dredging of productive shallow coves. Aeration and destratification are not recommended at this time. (Authors)

15106. Huisman, E. A., J. H. Koeman, and P. V. I. M. Wolff (Organisatie ter Verbetering van de Binnenvisserij te Utrecht, Netherlands). 1971. AN INVESTIGATION INTO THE INFLUENCE OF DDT AND OTHER CHLORINATED HYDROCARBONS ON THE FERTILITY OF THE PIKE. (Een Onderzoek naar de invloed van DDT en andere gechloreerde koolwaterstoffen op de vruchtbaarheid van de snoek). Ann. Report of the Organization for the Improvement of the Freshwater Fishery, April 1, 1970 - March 31, 1971, pp. 69-86. In Dutch with English summ.

Since 1965 a steady decline of the fertility percentage of the pike-eggs was observed in the O. V. B. pike-hatchery near lakes Westeinder and Brasemer. This was not observed in other Dutch waters where pike hatcheries are operating. From research done on this phenomenon the following results were obtained: The low fertility occurred only in the eggs and not in the sperm. The fertility of female pike longer than the mean length (76 cm) was lower than the fertility of smaller pike. As these lakes are situated in an area with intensified flower culture a negative effect of pesticides on the reproductive potential of pike was possible. During the last two years experiments were carried out to test the reliability of this hypothesis in four Dutch waters: Lake Westeinder; Lake of Naarden; waters surrounding Giethoorn; waters surrounding Grouw. These experiments, carried out in cooperation with the Department of Biological Toxicology of the Veterinary Faculty (University of Utrecht) and the Society for the Promotion of Nature Reserves in the Netherlands (Amsterdam) resulted in the following data. A comparison between the waters mentioned showed that a high residue of DDT (and its metabolites DDD and DDE) was accompanied by a low fertility (Lake Westeinder) and that a low DDT-residue was accompanied by a high fertility (Grouw, Giethoorn).

The few data from the Lake of Naarden do not permit clear conclusions concerning this water. A negative correlation could be demonstrated between the fertility and the DDT-residue of the eggs. (correlation coefficient $r = -0.495$: possibility factor $0.02 > P > 0.01$. The data, mentioned above, are possibly in correlation with the catches of the commercial fisherman in the Lake Westeinder. The catches during the last seven years showed a decline in the percentage of small pike; so the percentage distribution of length showed a shift to greater length. This phenomenon does not occur in the other waters examined. These results suggest that the contamination with DDT in the Lake Westeinder has reached a level negatively influencing the reproductive potential of pike. (Authors summ.)

15107. De Kinkelin, P., and Y. Le Turdu. 1971. THE ENZOOTIC OF ULCERATIVE DERMAL NECROSIS OF THE SALMON (Salmo salar, L. 1766) IN BRITTANY. (L'enzootie d'"ulcerative dermal necrosis" du saum (Salmo salar, L. 1766) en Bretagne). Bull. Francais de Pisciculture, No. 241, pp. 115-126.

This paper includes detailed review of British and Irish research on U. D. N. and observations and experiments carried out by the authors. In 1968/69 there was an apparent outbreak of U. D. N. in the north of France in the rivers Guer and Douron in the Atlantic salmon (S. salar) and saltwater brown trout (S. fario). Lesions occurred on the part of the head free from scales, became invaded by fungi and ultimately resulted in death of fish. Virological research did not show any viruses in electron microscopy of material from the lesions. There was no cytopathogenic effect in cell cultures, and no virus was seen in the ultrafiltrates. In S. fario exposed to infection, in the confinement, in the stream which was a tributary of the River Guer, 4 out of 20 trout exposed developed head ulcerations. In two of these trout examined for the presence of virus, no virus was found. The other two kept in water at 40°C died from fungus infection within 15 days. Well illustrated. -- S. F. Snieszko

15108. Koch, R. B., D. Desaiah, H. H. Yap, and L. K. Cutkomp (Dept. of Entomol., Fisheries and Wildl., Univ. of Minn., St. Paul, Minnesota). 1972. POLYCHLORINATED BIPHENYLS: EFFECT OF LONG-TERM EXPOSURE ON ATPase ACTIVITY IN FISH, Pimephales promelas. Bull. Environ. Contamination and Toxicology, 7(2/3): 87-92.

Fathead minnows, Pimephales promelas, were chronically exposed to Aroclors 1242 and 1254 for several months. All fish showed responses of ATPase activities to exposure to the Aroclors compared to control fish. Both inhibition and stimulation responses were observed for the different tissues tested and variations occurred between the two Aroclors.

15109. Kihlstrom, J. E., and L. Hulth (Inst. of Zoophysiol., Uppsala, Sweden). 1972. THE EFFECT OF PHENYLMERCURIC ACETATE UPON THE FREQUENCY OF HATCHING OF EGGS FROM THE ZEBRAFISH. Bull. Environ. Contamination and Toxicology, 7(2/3): 111-114.

The effect of phenylmercuric acetate upon the frequency of hatching and the time required for development of eggs from zebrafishes was investigated. The frequency of hatching was significantly higher in water containing 10 ng phenylmercuric acetate per g than in the controls. At a concentration of 20 ng per g of water the frequency of hatching was the same as in the controls, and none of the studied eggs survived at a concentration of 50 ng/g. Most eggs hatched about three days after fertilization. However, the frequency of eggs hatching up to and including the third day after fertilization is significantly higher in water containing 10 and 20 ng phenylmercuric acetate per g than in non-polluted water.

15110. Hesselberg, R. J., and J. L. Johnson (U. S. Dept. of Interior, Bur. Sport Fish. & Wildl., Fish-Pesticide Res. Lab., Columbia, Missouri). 1972. COLUMN EXTRACTION OF PESTICIDES FROM FISH, FISH FOOD AND MUD. Bull. Environ. Contamination and Toxicology, 7(2/3): 115-120.

This paper reports a new column extraction procedure that is efficient, fast and inexpensive for separating pesticides from fish, fish food, and mud samples.

15111. Fletcher, G. L., and R. F. Addison (Fish. Res. Bd. of Canada, Mar. Ecol. Lab., Bedford Inst., Dartmouth, Nova Scotia, Canada). 1972. SOME ASPECTS OF THE CHEMISTRY AND ACUTE TOXICITY OF THE IRON ORE FLOTATION AGENT DIMETHYL AMMONIUM ALKYL HYDROXAMATE AND SOME RELATED COMPOUNDS TO BROOK TROUT. Bull. of Environ. Contamination and Toxicology, 7(2/3): 147-159.

Dimethyl ammonium alkyl hydroxamate (DMAH) was lethal to brook trout (Salvelinus fontinalis) at concentrations as low as 4.5 mg/l. Since DMAH consisted of a number of molecular species in equilibrium, experiments were conducted with several of them in an attempt to evaluate their contribution to its toxicity. Of the compounds tested dimethylamine proved to be non-toxic, hydroxylamine was as lethal as DMAH (on a molar basis) and NaC_{10} hydroxamate was 5-10 times more toxic than hydroxylamine of DMAH. These results suggested that although hydroxylamine may have played a small part in the toxicity of DMAH, the hydroxamate group appeared to be the major lethal component. (Authors summ.)

15112. Echelle, Anthony A., Clark Hubbs, and Alice F. Echelle (Univ. of Texas, Austin, Texas). 1972. DEVELOPMENTAL RATES AND TOLERANCES OF THE RED RIVER PUPFISH, Cyprinodon rubrofluviatilis. The Southwestern Naturalist, 17(1): 55-60.

Eggs of Cyprinodon rubrofluviatilis can be successfully incubated at temperatures between 14.0 and 36.4°C. The upper limit slightly exceeds that previously reported in the literature. (Authors)

15113. Grachev, L. Ye. (All-Union Res. Inst. for Sea Fish. and Oceanogr., (VNIRO), Moscow). 1971. ALTERATION IN THE NUMBER OF OOCYTES IN THE PINK SALMON [Oncorhynchus gorbuscha (Walbaum)] IN THE MARINE PERIOD OF LIFE. Journal of Ichthyology published by Amer. Fish. Soc., 11(2): 199-206.

Data are given concerning the number of oocytes in pink salmon of different degrees of maturity (from underyearlings to individuals proceeding to spawn). It has been found that the number of oocytes is reduced as the gonads mature. The rate of degeneration of the oocytes is connected with the rate of maturation and weight increase. No significant difference is noted in fecundity dynamics in ontogeny between strong and weak year-classes. (Auth.)

15114. Georgiev, George S. (Higher Inst. of Vet. Med., Sofia, Bulgaria). 1971. CAROTENOIDS AND VITAMIN A IN Salmo irideus EGGS AND THEIR SIGNIFICANCE IN THE INITIAL PERIODS OF THE EMBRYOGENESIS. Folia Balcanica 2, No. 9, 1-11 (Fish. Inst. of S.R. of Macedonia, Post. fah 190, Skopje, Yugoslavia); Commercial Fisheries Abstracts, 25(5): p. 23.

Earlier, researchers have shown that the high mortality rate during the incubation of eggs of rainbow trout is due to the absence of some essential substances which the mother fish failed to provide the eggs. S. Hirao and J. Yamada [Bull. Japan. Soc. Sci. Fish. 21, 240-243 (1955)] found that rainbow trout eggs lacking in iron and vitamin B_{12} show lowered percentage of hatching. In the present study, the author determined the levels of carotenoids and vitamin A in trout eggs and tried to correlate these values with the maturity of the eggs and the discharge of the eggs by the female. They found that (1) the carotenoid and vitamin A content of the eggs is greater in the eggs last to mature, (2) the main pigment in the eggs of naturally developing trout was astaxanthin and in the eggs of artificially bred trout was lutein, (2) the vitamin A content in the eggs of artificailly bred trout is higher than that of naturally bred trout, and (4) the eggs with low carotenoid content showed a high mortality rate during the period of greatest sensitivity between the 12th and 15th day of incubation.

15115. Sparks, Richard E., and John Cairns, Jr. (Dept. of Biol., Va. Polytech. Inst. and State Univ., Blacksburg, Virginia 24061). 1972. THE RESPONSE OF BLUEGILL SUNFISH (Lepomis macrochirus Rafinesque) TO SEISMIC SHOCK. Hydrobiologia, 39(2): 273-276.

Apparently fish exhibit a fright response to earthquakes that is similar to that of humans.

15116. Stickney, Robert R., and James W. Andrews (Skidaway Inst. of Oceanogr., 55 West Bluff Rd., Savannah, Georgia 31406). 1972. THE EFFECTS OF DIETARY LIPIDS ON GROWTH, FOOD CONVERSION, LIPID AND FATTY ACID COMPOSITION OF CHANNEL CATFISH. J. Nutr., 102(2): 249-257; Comm. Fish. Abstr., 25(5): p. 23.

Channel catfish (Ictalurus punctatus) fingerlings were reared in 1-m-diameter fiberglass tanks at 26° and fed 27 experimental diets differing in source of lipid. Duplicate groups of fish were fed each of eight primary lipid sources and each lipid was fed at a level of 10% of diets in three molecular forms: triglyceride, free fatty acid, and ethyl ester. Highest average weights occurred when the fish were supplemented with beef tallow, olive oil and menhaden oil triglycerides. Substantially lower gains were obtained from groups fed short- and medium-chain fatty acids, a fat-free diet, safflower oil (high in 18:2ω6) and linseed oil (high in 18:3ω3). In general, triglyceride and ethyl ester diets led to more rapid growth of channel catfish than did free fatty acid diets. Food conversions for fish fed triglyceride diets were superior to those of fish on the other two dietary lipid types. The deposition of fatty acids in whole carcasses followed very closely the fatty acid composition of the diet whereas deviation from the dietary fatty acid composition was noted in liver. (Authors)

15117. Castell, J. D., R. O. Sinnhuber, D. J. Lee, and J. H. Wales (Dept. of Food Sci. and Technology, Oregon State Univ., Corvallis, Oregon 97331). 1972. ESSENTIAL FATTY ACIDS IN THE DIET OF RAINBOW TROUT (Salmo gairdneri): PHYSIOLOGICAL SYMPTOMS OF EFA DEFICIENCY. J. Nutr., 102(1): 87-92; Comm. Fish. Abstr., 25(5): p. 23.

Certain physiological changes in rainbow trout (Salmo gairdneri) which may be attributed to a dietary insufficiency of the essential fatty acids of the linolenic or 3 series are described. A greatly increased mitochondrial swelling rate was induced in fish fed a fat-free diet. Linolenic acid was most effective in reducing the swelling phenomenon. Diets without 3 fatty acids showed an increased liver respiration rate, a slightly lower hemoglobin content and increased muscle water. (Authors)

15118. Castell, J. D., D. J. Lee, and R. O. Sinnhuber (Dept. of Food Sci. and Technology, Oregon State Univ., Corvallis, Oregon 97331). 1972. ESSENTIAL FATTY ACIDS IN THE DIET OF RAINBOW TROUT (Salmo gairdneri): LIPID METABOLISM AND FATTY ACID COMPOSITION. J. Nutr., 102(1): 93-100; Comm. Fish. Abstr., 25(5): p. 24.

The fatty acid composition of the liver, heart, kidney, brain and body lipids of fish fed either a fat-free diet or those containing known amounts of oleic, linoleic, or linolenic was determined. A fat-free diet or one containing oleic acid was a sole lipid source resulted in elevated levels of eicosatrienoic acid (20:3ω9). Dietary linoleate and linolenate both depressed the triene levels. The former acid elevated 20:4ω6 and 22:5ω6 concentrations and the latter increased 22:6ω3 tissue levels. Dietary lipids affected the fatty acid composition of phospholipids to a greater degree than those in the neutral lipids. The demonstrated requirement for the ω3 fatty acids by fish suggest that the 20:3ω9/22:6ω3 ratio in the phospholipid fraction be used as an index of essential fatty acid nutrition. Fish receiving 0.7% or more of linolenate in the diet had 20:3ω9/22:6ω3 ratios of less than 0.4. Diets which produce this ratio value or less appear to be adequate in the ω3 fatty acids (linolenate series) and fulfill the nutritional requirements of young fish as judged by growth and other physiological parameters. (Authors)

15119. McConnell, Robert J., and George R. Snyder (NMFS, Northwest Fish. Center, 2725 Montlake Blvd. East, Seattle, Washington 98102). 1972. KEY TO FIELD IDENTIFICATION OF ANADROMOUS JUVENILE SALMONIDS IN THE PACIFIC NORTHWEST. NOAA Technical Report NMFS CIRC-366, 5 p. illus.

A key is presented with descriptive illustrations to help in field identification of live, juvenile salmonids in fresh waters of the Pacific Northwest. Other juvenile fish that may be mistakenly identified as salmonids are included. (Authors)

15120. Castell, J. D., R. O. Sinnhuber, J. H. Wales, and D. J. Lee (Dept. of Food Sci. and Technology, Oregon State Univ., Corvallis, Oregon 97331). 1972. ESSENTIAL FATTY ACIDS IN THE DIET OF RAINBOW TROUT (Salmo gairdneri): GROWTH, FEED CONVERSION AND SOME GROSS DEFICIENCY SYMPTOMS. J. Nutr., 102(1): 77-86; Comm. Fish. Abstr., 25(5): p. 25.

Experiments are described to define further the fatty acid requirements of rainbow trout (Salmo gairdneri). In all cases, feeding semipurified diets containing no polyunsaturated fatty acids resulted in poor growth and feed conversion. Linolenic acid was superior to linoleic in stimulating growth and improving feed conversion. The requirement of linolenic acid (3 fatty acids) for rainbow trout is 1% of the diet or approximately 2.7% of the dietary calories. Essential fatty acid deficiency symptoms that were cured or prevented by linolenic acid included fin erosion, heart myopathy, and a shock syndrome. It is concluded that linolenic acid has an essential role in rainbow trout similar to that assigned to linoleic acid in man and higher animals. (Authors)

15121. Luk'yanenko, V. I. (Central Sci. Res. Inst. of Sturgeon Culture, Astrakhan, AN SSSR). 1970. ON THE MECHANISM OF ACTION OF PHENOL ON THE CENTRAL NERVOUS SYSTEM OF FISH IN CONNECTION WITH CHANGE OF THE EXTERNAL SYMPTOM COMPLEX OF PHENOL INTOXICATION UNDER THE INFLUENCE OF ANTICHOLINESTERASE PREPARATIONS (O mekhanizme deĭstviya fenola na tsentral'nuyu nervnuyu sistemu ryb v svyazi s izmeneniem vneshnogo simptomokompleksa fenol'noĭ intoksikatsii pod vliyaniem antikholinesteraznykh preparatov). Voprosy Vodnoĭ Toksikologii, AN SSSR, "Nauka", Moscow, 154-162. Translated by Robert M. Howland.

This investigation was undertaken for the purpose of establishing the character of influence of anticholinesterase preparations on the external symptom complex of phenol intoxication, which in turn would permit the forming of an opinion about the role of the complex of acetylcholinesterases in the reactions of fish to phenol irritation. Phosphacol, eserine and proserine have an expressed inhibitory effect on the external symptom complex of phenol intoxication of crucian carp. The expressiveness of the inhibitory effect is determined by the pharmacological properties of the preparation, the dose and the time of preliminary action before immersion of the fish in a toxic phenol solution. Phosphacol proved to be most effective; it prevented and completely inhibited all components of the phenol reaction of crucian carp. Proserine showed a considerably less expressed action. In the majority of cases it only delayed and noticeably weakened the reaction of fish to phenol. Eserine occupies an intermediate position. Most often it completely inhibited the development of phenol intoxication; however, at doses exceeding the doses of phosphacol by many times.

15122. Page-Jones, R. M. (White Fish Auth., Mar. Fish Cult. Unit, Hunterston, Scotland). 1971. A SALINITY INDICATOR FOR USE IN MARINE FISH FARMING. Journal du Conseil, 34(1): 121-123.

In marine fish farming there is a need for a low cost instrument to enable salinity to be measured quickly and simply, without the complexity and expense normally associated with oceanographic salinometers. The limited accuracy required has made it possible to construct an enclosed, direct reading salinity indicator which is extremely simple to operate. The overall accuracy is $\pm$ 0.5 $^{o}/_{oo}$.

15123. Schuyf, A., and S. J. deGroot (Lab. of Comp. Physiol., Univ. of Utrecht, Netherlands). 1971. AN INDUCTIVE LOCOMOTION DETECTOR FOR USE IN DIURNAL ACTIVITY EXPERIMENTS IN FISH. Journal du Conseil, 34(1): 126-131.

This detector uses the induction voltage which is generated in a fixed, oblong, rectangular coil when a fish provided with a permanent magnet crosses the coil. The inductive method is effective up to about 0.8 m, and the coil may be lengthened to the width of the area in which one wishes to detect the passing fish.

15124. Bromley, P. J. (Fish. Lab., Lowestoft, Suffolk, England). 1971. RELATIONSHIPS BETWEEN THE WET WEIGHT CONDITION FACTOR AND NITROGEN ENERGY CONTENT IN THE COMMON SOLE (Solea solea L.). Journal du Conseil, 34(1): 131-135.

In an experiment with yearling sole (Solea solea L.) correlations were found between the wet weight condition factor, Kw (where Kw = wet weight/L^3, in g/cm^3) and the nitrogen and energy contents. Equations are presented that can be used for estimating the total nitrogen or energy content of the fish directly from length and weight, and for expressing the nitrogen and energy content per unit weight. Although these results are only preliminary they suggest a possible method of indirect calorimetry and nitrogen determination that might with suitable expansion be applied to other fish, including samples taken from natural populations.

15125. Gurova, G. V., S. K. Krasnov, and N. D. Mazmanidi (Saratov Div. of the State Sci. Res. Inst. of Lake and River Fishery, Saratov, AN SSSR). 1970. THE EFFECT OF CERTAIN HALIDES OF PHOSPHORUS ON FISH DURING ONTOGENY. (Vliyanie Nekotorykh Galogenidov Fosfora na Ryb v Ontogeneze). Voprosy Vodnoĭ Toksikologii, AN SSSR, "Nauka", Moscow, 136-141. Translated by Robert M. Howland.

Experiments on the effect of trichloride of phosphorus and pentachloride of phosphorus on the embryonal and post-embryonal development of the stellate sturgeon, crucian carp, perch, northern pike and ide were conducted. At concentrations of 150 and 100 mg/l the spawn perishes at the stage of 4-8 blastomeres 5-6 hours after the start of fertilization. At concentrations of 70 mg/l from trichloride of phosphorus 100%, and from pentachloride of phosphorus 30% of the prelarvae proved to be malformed.

15126. Baumeister, Robert. 1972. CHEMICAL ANALYSES OF SELECTED PUBLIC DRINKING WATER SUPPLIES (INCLUDING TRACE METALS). Dept. of Natural Resources, Madison, Wisconsin, Technical Bull. No. 53, 16 p.

Drinking water supplies utilizing ground and surface water sources were sampled for trace elements in addition to the standard chemical analysis. None of the raw water samples exceeded the Public Health Service Drinking Water Standards for chemical quality, and only one sample from a distribution system exceeded the standards. The one parameter exceeded was lead (.06 mg/l reported, .01 mg/l higher than the standard) which leached from a service line because of corrosive water in the distribution system. Corrosive water in other systems also caused increased concentrations of copper and zinc. (Auth.)

15127. Fabacher, David L., and Howard Chambers (Dept. of Entomol., Miss. State Univ., State College, Mississippi). 1972. ROTENONE TOLERANCE IN MOSQUITOFISH. Environmental Pollution, 3(2): 139-141.

Resistant mosquitofish showed a 1.8-fold tolerance to rotenone over a susceptible strain. The 24-h LC_{50} values for rotenone in susceptible and resistant mosquitofish were 0.017 ppm and 0.031 ppm, respectively. Results with sesamex, an inhibitor of mixed-function oxidase (mfo) enzymes, indicated that rotenone tolerance in mosquitofish is solely the result of increased levels of mfo enzymes. (Authors)

15128. Mackie, P. R., A. S. McGill, and R. Hardy (Torry Res. Sta., Aberdeen, Scotland). 1972. DIESEL OIL CONTAMINATION OF BROWN TROUT (Salmo trutta L.) Environmental Pollution, 3(1): 9-16.

Hydrocarbons chemically identical to those present in diesel fuel oil have been isolated from trout caught eleven days after a spillage of diesel fuel oil had occurred in their environment. Both the fish after cooking and the hydrocarbon fraction isolated from the uncooked fish were found to smell and taste in a manner reminiscent of the fuel oil. (Authors)

15129. Sanders, Herman O., and Jack H. Chandler (Bur. Sport Fish. and Wildl., Fish-Pesticide Res. Lab., Columbia, Missouri). 1972. BIOLOGICAL MAGNIFICATION OF A POLYCHLORINATED BIPHENYL (AROCLOR 1254) FROM WATER BY AQUATIC INVERTEBRATES. Bull. of Environ. Contamination & Toxicology, 7(5): 257-263.

15130. Lebedeva, G. D. 1970. DETERMINATION OF THE TOXICITY OF POLLUTED FRESH WATERS IN RESPECT TO CERTAIN HYDROBIONTS. (Opredelenie Toksichnosti Zagryaznennykh Presnykh Vod v Otnoshenii Nekotorykh Gidrobiontov). Voprosy Vodnoĭ Toksikologii, Publisher "Nauka", Moscow, 57-61. Translated by Robert M. Howland.

Plant organisms, which are able to accumulate radioactive strontium most intensively, prove to be less sensitive to water pollution by this element. Of the animal organisms investigated, daphnia are the most sensitive to water pollution by radioactive strontium. In the pollution of fresh waters with radioactive substances, reproduction and fecundity should be considered as the most sensitive criteria of the toxicity for animals. (Auth. conclusions)

15131. Laptev, V. I. 1967. AN EXPERIMENT ON THE STERILIZATION OF WATER WITH ULTRAVIOLET RAYS. (Opyt Sterilizatsii Vody Ul'trafioletovymi Luchami). Trudy Vsesoyuznogo Nauchno-Issledovatel'skogo Instituta Prudovogo Rybnogo Khozyaĭstva, Voprosy Prudovogo Rybovodstva, Vol. 15, "Pishchevaya Promyshlennost'," Moscow, 284-286. Translated from Russian by Robert M. Howland.

Preliminary experiments conducted on the sterilization of water show that UV-rays act fatally on Trichodina, Chilodonella and cercariae. The most-advanced bactericidal apparatuses (increase of passing ability and lamp strength) are necessary to assure sterility of the water to be used for filling ponds where young fish are reared or held.

15132. Youngs, William D., Walter H. Gutenmann, and Donald J. Lisk (Dept. of Nat. Resources and Pesticide Residue Lab., Cornell Univ., Ithaca, New York). 1972. RESIDUES OF DDT IN LAKE TROUT AS A FUNCTION OF AGE. Environ. Science and Technology, 6(5): 451-452.

In lake trout of accurately known age, residues of p, p'-DDE, p, p'-DDD, and p, p'-DDT increased progressively with age from about 1 ppm at 1 year to concentrations of about 14 ppm or higher at 12 years. The correlation between total residues (p, p'-DDE, p, p'-DDD, and p, p'-DDT) in fish and their age was highly significant. (Authors)

15133. Schindler, D. W., and G. W. Comita (Freshwater Inst., Fish. Res. Bd. of Canada, Winnipeg, Manitoba, Canada). 1972. THE DEPENDENCE OF PRIMARY PRODUCTION UPON PHYSICAL AND CHEMICAL FACTORS IN A SMALL, SENESCING LAKE, INCLUDING THE EFFECTS OF COMPLETE WINTER OXYGEN DEPLETION. Arch. Hydrobiol., 69(4): 413-451.

Water chemistry, primary production and phytoplankton were studied in a small eutrophic lake over a period of several years. Changes in the chemistry and biota which accompanied the complete disappearance of oxygen under winter ice in the final year of study were observed. (Authors)

15134. Wali, M. K., G. K. Gruendling, and D. W. Blinn (Dept. of Biol., Univ. of No. Dakota, Grand Forks, North Dakota). 1972. OBSERVATIONS ON THE NUTRIENT COMPOSITION OF A FRESHWATER LAKE ECOSYSTEM. Arch. Hydrobiol., 69(4): 452-464.

Chemical characteristics of water, sediments and plants were examined in the Marion Lake ecosystem in British Columbia, Canada. Mineral nutrient and other trace metal content of the water is low and yet fairly high in the sediments. Low nutrient levels in water may be attributed not only to the flushing of the lake and high rainfall, but also to the binding of the ions by the high organic matter content in the sediments. High nutrient content of the sediment is due to runoff and seepage from the surrounding, not yet stabilized, forest. Statistical tests were run on all the analyses and the significant results are presented. It is suggested that low phytoplankton productivity can be attributed to the low nutrient levels in water, the higher productivity of epipelic and benthic algae to the high nutrient content at the mud-water interface, and the high productivity of macrophytes to the high nutrient content of the sediments. (Authors)

15135. Wieclawski, Franciszek (Instytut Hydrobiologii i Ochrony Wod, Wyzsza Szkola Rolnicza, Olsztyn, Poland). 1972. A METHOD OF CONCENTRATING TRACES OF HEAVY METAL IONS FROM LAKE WATERS. Acta Hydrobiologica, 14(1): 57-66. In English.

The usefulness of the dithizone column for separating and initially concentrating traces of heavy metal ions (Pb, Cd, Zn, Mn, Cu, and Co) from lake waters was checked. The fully described methods applied include the collection of water samples, the preparation of the dithizone extraction column, and the determination of trace heavy metals by means of the polarographic method. The periodically great biological production of lake waters and the variable oxygen conditions prevailing in them make it difficult to make full use of all the advantages of the tested method. (Auth.)

15136. Vrochinskiĭ, K. K. (VNIIGINTOKS). 1972. TOWARD PREDICTION OF THE DYNAMICS OF PHOZALON RESIDUES IN THE WATER OF BODIES OF WATER (K prognozirovaniyu dinamiki ostatkov fozalona v vode vodoemov). Rybnoe Khozyaĭstvo, No. 2, pp. 16-17. In Russian.

Experiments were performed in model bodies of water filled with pond water with the addition of one of the most-used organophosphorus pesticides - phozalon. Equations are presented which allow prediction of the phozalon residue in the water (in % of original amount) at specific intervals after its application.

15137. Beamish, R. J. (Fish. Res. Bd. of Canada, Freshwater Inst., Winnipeg, Manitoba, Canada). 1972. DESIGN OF A TRAPNET FOR SAMPLING SHALLOW-WATER HABITATS. Fish. Res. Bd. Canada Technical Report No. 305, 14 p.

The use and construction of a versatile lightweight trapnet is described. The nets have successfully fished for freshwater and marine species in areas where conventional collecting techniques were difficult to apply. Such nets have proved especially useful for the capture of small fish. (Auth.)

15138. Nuzzi, Robert (N. Y. Ocean Sci. Lab., Montauk, New York). 1972. TOXICITY OF MERCURY TO PHYTOPLANKTON. Nature, 237(5349): 38-40.

Mercury, as phenylmercuric acetate (PMA), was found to be inhibitory to three phytoplankton species at concentrations as low as 0.06 $\mu g\ l^{-1}$.

15139. Grabda, Jadwiga (editor). 1971. PARASITES OF CYCLOSTOMES AND BONY FISHES. PART II. LIST OF PARASITES IN POLAND. (Pasozyty Kraglousty ch i Ryb. Parasiti cyclostomatorum et piscium. Part II. Catalogus Faunae Parasticae Poloniae). Warsaw, Poland, 304 p.

This is a host-parasite list of Polish cyclostomes and bony fishes. Lampetra fluviatilis is the only representative of Cyclostomata. Bony fishes, Pisces, are represented by 74 species of freshwater and marine fishes. The list of parasites includes Protozoa, Platyhelminthes, Nemathelminthes, Acanthocephala, Annelida and Arthropoda. There is also a list of pertinent Polish publications, selected foreign references, taxonomic index of hosts and parasites and several brief glossaries. It is a very complete catalog which includes geographic distribution of parasites and the anatomical location of parasites in hosts. -- S. F. Snieszko

15140. Mills, James G., Jr. (Mar. Res. Lab., Fla. Dept. of Nat. Resources, St. Petersburg, Florida). 1972. BIOLOGY OF THE ALABAMA SHAD IN NORTHWEST FLORIDA. State of Fla. Dept. of Nat. Resources Tech. Series No. 68, 24 p.

Biology of Alabama shad, Alosa alabamae, in the Apalachicola River was studied from June 1968 to April 1971. Adults enter the river in February and spawn in April. Spawning occurs at 19-22°C in moderate currents over bottom of coarse sand and gravel. Fecundity ranges from 61,238 to 257,655. Gonads of shad entering the river were in ripe condition with stage IV oocytes averaging 1159 μ in diameter. The 1969 collection contained 38.3% repeat spawners while the 1970 collection contained 6.3%. Mean fecundity increased 25.8%, although repeat spawners decreased 32%. Adult males enter the river in larger numbers than females at water temperatures below 17°C. Adult shad do not feed during the spawning run. One, two, and three year old shad make the spawning run.

Female mean length and weight were 394 mm (TL) and 737 g while male mean length and weight were 349 mm (TL) and 474 g. Length frequency analysis of juveniles indicates progeny of three spawning groups, their origins being the Chipola River, The Chattahoochee-Flint River, and the Jim Woodruff Dam. Most juvenile shad grew 30 mm per month. Juveniles emigrate from the river at 125 mm (FL) or in December. Sport fishing potential is good since catch frequency is estimated as one shad per rod every 29.72 minutes. (Auth.)

15141. Cairns, John, Jr., Richard E. Sparks, and William T. Waller (Va. Polytechnic Inst. and State Univ., Blacksburg, Virginia 24061). 1972. THE DESIGN OF A CONTINUOUS FLOW BIOLOGICAL EARLY WARNING SYSTEM FOR INDUSTRIAL USE. 27th Purdue Industrial Waste Conf., May 2 - 4, 1972 at Purdue University, 21 p. plus 6 tables, 7 figs.

The time has come to go beyond merely responding to one environmental crisis after another and to manage all ecosystems on a regional basis. Proper management will insure that benefits are optimized and that each system serves a variety of uses. Management of aquatic ecosystems requires a clear understanding of the goals to be achieved, appropriate information and the means to achieve the goals. Control measures applied to aquatic ecosystems, in the absence of information on the condition of the system, are apt to be inappropriate and thus may overprotect the receiving system at times and underprotect it at other times since the ability of ecosystems to receive wastes is not constant. A major determinant of the effectiveness and efficiency of ecological quality control is the lag time in the feedback of information. If the lag is too great, the control measures may repeatedly overshoot or undershoot the desired goal. Present techniques for measuring the responses of aquatic organisms and communities require days or weeks, whereas information for ecosystem quality control and prevention of ecological crises should be generated in minutes or hours as is the case for other quality control systems. A biological monitoring system has been developed to generate information rapidly. The system measures changes in the movement and breathing of fish in order to provide an early warning of developing toxicity in the wastes of an industrial plant. (Authors)

15142. Aulstad, Dag, Trygve Gjedrem, and Harald Skjervold (The Agric. Coll. of Norway, Inst. of Animal Genetics and Breeding, AS-NLH, Norway). 1972. GENETIC AND ENVIRONMENTAL SOURCES OF VARIATION IN LENGTH AND WEIGHT OF RAINBOW TROUT (Salmo gairdneri). J. Fish. Res. Bd. Canada, 29(3): 237-241.

Rainbow trout (Salmo gairdneri) of three-year-classes (1967-1969) were produced from random mating, and one-year-class (1970) from inbreeding. The two first-year-classes were fullsib groups. Intraclass-correlations for body length in the 1967-year-class were: 0.16, 0.15, 0.09, and 0.17 at 90, 130, 355 and 485 days of age, respectively. The corresponding estimate for the 68-year-class was 0.25 at age 110 days. Phenotypic correlations between body length at different ages were high within seasons, but low between seasons. For the 1969-year-class the sire x dam interaction component was negative at ages 150 and 280 days, indicating that nonadditive gene effects were unimportant. Estimated heritabilities ranged from 0.0 to 0.40, those from the sire component being generally higher. Environmental differences between tanks were low, but not ignorable. The 1970-year-class, produced from first generation of fullsib mating, showed significant differences between inbred and control (noninbred) for mortality of eggs and fry, but not for body weight at age 75 days. (Authors)

15143. Stroganov, N. S., V. G. Khobot'ev, and L. V. Kolosova (Moscow State Univ., USSR). 1970. STUDY OF THE CONNECTION OF THE CHEMICAL COMPOSITION OF ORGANOMETALLIC COMPOUNDS WITH THEIR TOXICITY FOR HYDROBIONTS. (Izuchenie Svyazi Khimicheskogo Sostava Metallorganicheskikh Soedinenii s ikh Toksichnost'yu dlya Gidrobiontov). Voprosy Vodnoĭ Toksikologii, AS USSR, "Nauka", 66-74.

15144. Griffiths, J. S., and D. F. Alderdice (Fish. Res. Bd. of Canada Biol. Sta., Nanaimo, British Columbia, Canada). 1972. EFFECTS OF ACCLIMATION AND ACUTE TEMPERATURE EXPERIENCE ON THE SWIMMING SPEED OF JUVENILE COHO SALMON. J. Fish. Res. Bd. Canada, 29(3): 251-264.

Swimming performance of juvenile coho salmon (Oncorhynchus kisutch), 7.5-9.5 cm in total length, was investigated in a stamina tunnel, generally at 3 C intervals of temperature over the range of thermal tolerance. Optimum (ultimate maximum) performance (5.8 lengths/sec) occurred at a combination of acclimation and test temperatures near 20 C. A declining ridge of sub-optimum performance (test temperature ridge) was found at acclimation temperatures below 20 C; maximum performance at each acclimation temperature level was found on the ridge at test temperatures higher than those of acclimation. Conversely, maximum performance at given test temperatures occurred on a second ridge (acclimation temperature ridge) at acclimation temperatures near those of testing. There was an apparent shift in location of the acclimation temperature ridge, indicative of seasonal performance compensation and improved capacity to perform at low acclimation temperatures during the winter period. At test temperatures below 5 C, maximum performance occurred at acclimation temperatures of about 6-8 C. Lowest performance within the zone of thermal tolerance was associated with acclimation and test temperatures of 2 C. (Authors)

15145. Griffith, J. S., Jr. (Idaho Coop. Fish. Unit., Univ. of Idaho, Moscow, Idaho 83843). 1972. COMPARATIVE BEHAVIOR AND HABITAT UTILIZATION OF BROOK TROUT (Salvelinus fontinalis) AND CUTTHROAT TROUT (Salmo clarki) IN SMALL STREAMS IN NORTHERN IDAHO. J. Fish. Res. Bd. Canada, 29(3): 265-273.

Individual brook (Salvelinus fontinalis) and cutthroat (Salmo clarki) trout communicated with similar behavioral signals, both in laboratory stream-channels and in northern Idaho streams. Underyearling brook trout were less active socially than equal-sized cutthroat trout in laboratory observations. In study streams, brook trout maintained a 20-mm size advantage over cutthroat of the same age-groups throughout their lives, as they emerged from the gravel before cutthroat. Because of this size advantage, underyearling brook trout of sizes found in study streams in September consistently dominated in experiments the underyearling cutthroat with which they normally lived. But in study streams underyearlings of the two species utilized different microhabitats, particularly with respect to water depth, and so minimized chances for interaction. Yearling and older brook trout initiated 40% fewer aggressive encounters under laboratory conditions than did equal-sized cutthroat trout, and did not displace the cutthroat. In study streams with sympatric populations, cutthroat trout of these age-groups occupied territories with focal points of higher water velocities (averaging 10.2-10.3 cm/sec) than those occupied by brook trout (averaging 7.6-9.6 cm/sec). Considerable interspecific overlap in other habitat characteristics occurred for trout of age-groups I and II. The oldest members of the two species segregated more distinctly, as the brook trout lived closer to overhead cover. (Auth.)

15146. Dechtiar, Alex O. (Ont. Dept. of Lands and Forests, Research Branch, Maple, Ontario, Canada). 1972. PARASITES OF FISH FROM LAKE OF THE WOODS, ONTARIO. J. Fish. Res. Bd. Canada, 29(3): 275-283.

Results of a survey of the parasite fauna of fish from Lake of the Woods and adjacent lakes are presented. Over 600 fish representing 41 species were examined, and 170 species of parasites, mostly helminths, are recorded. Every species of fish and 97% of all fish examined carried at least one parasite. No parasites considered hazardous to human health were found. A number of parasites, reported elsewhere as contributors to fish mortalities, are recorded. (Auth.)

15147. Bilton, H. T. (Fish. Res. Bd. of Canada Biol. Sta., Nanaimo, British Columbia, Canada). 1972. IDENTIFICATION OF MAJOR BRITISH COLUMBIA AND ALASKA RUNS OF EVEN-YEAR AND ODD-YEAR PINK SALMON FROM SCALE CHARACTERS. J. Fish. Res. Bd. Canada, 29(3): 295-301.

The present study indicates to what extent the various even- and odd-year pink

salmon runs originating in British Columbia and Alaska may be identified from two scale characteristics. Discriminant function analysis indicates that for both the even- and odd-year runs in most instances only small proportions of each of the runs could be correctly identified to their specific place of origin. The only exceptions were the Fraser River and Aleutians runs where more than half were correctly classified to their place of origin. However, quite large proportions of most of the major even- and odd-year runs from the British Columbia and Alaska regions could be correctly classified to their region of origin. An analysis, using a simple regression line method, of fish grouped into two regions rather than by run indicates that quite large proportions of fish from both even- and odd-year runs from the British Columbia and Alaska regions could be correctly classified to their region of origin. It would appear that the simpler analysis was equally as good as the discriminant function analysis of the individual runs for classifying fish to their region of origin on the basis of only two scale characters. (Auth.)

15148. McKeown, B. A., and A. P. van Overbeeke (Dept. of biol. Sciences, Simon Fraser Univ., Burnaby 2, British Columbia, Canada). 1972. PROLACTIN AND GROWTH HORMONE CONCENTRATIONS IN THE SERUM AND PITUITARY GLAND OF ADULT MIGRATORY SOCKEYE SALMON (Oncorhynchus nerka). J. Fish. Res. Bd. Canada, 29(3): 303-309.

When sockeye salmon entered the Fraser River the prolactin content of the serum and the pituitary gland was reduced by 27 and 36%, respectively. During migration to the spawning grounds the serum concentration increased considerably (81%), while the pituitary concentration was gradually restored to that of the first seawater sample. Serum concentration of growth hormone gradually increased during the migration (29%), while growth hormone in the pituitary glands initially decreased (13%) then increased (12%) as the fish approached the spawning grounds. The changes in prolactin concentrations appear to be related to a change in salinity, whereas growth hormone changes were unaltered at this time. (Authors)

15149. Heyl, Henry L., and Stanley J. Carpenter (Dept. of Anatomy, Dartmouth Medical School, Hanover, New Hampshire 03755). 1972. REVERSIBLE CHANGES IN ADRENAL CORTICAL CELL MORPHOLOGY AND PLASMA HYDROXYCORTICOSTEROIDS DURING FRESHWATER PORTION OF THE SPAWNING JOURNEY OF ATLANTIC SALMON (Salmo salar). J. Fish. Res. Bd. Canada, 29(3): 311-314.

Adrenal cortical tissue taken from Atlantic salmon netted in the estuary of the Miramichi River, New Brunswick, at three stages of gonadal activity showed increasing hyperplasia from July to October, with varying degrees of regression or degeneration by the following April. Adrenal cortical cells in April fish contained a characteristic paranuclear dense body, the light and electron microscopic appearances of which are described and discussed. Levels of 17-hydroxycorticosteroids in the plasma almost doubled from July to October and returned to July values by the following April. The presence of these cyclic changes in Atlantic salmon and their absence in Pacific salmon are discussed. Data indicate that genetic factors may be important in determination of the capacity for multiple spawning journeys by some Atlantic salmon. (Authors)

15150. Newman, Joseph T., Jr., Benjamin J. Cosenza, and John D. Buck (Biol. Sci. Group, Microbiology Section and Mar. Res. Lab., Univ. of Conn., Storrs, Connecticut 06268). 1972. AEROBIC MICROFLORA OF THE BLUEFISH (Pomatomus saltatrix) INTESTINE. J. Fish. Res. Bd. Canada, 29(3): 333-336.

From 65 bluefish caught in Long Island Sound, 433 isolates of bacteria from the intestinal contents were assigned to various groups, the most abundant being Vibrio, Pseudomonas, Enterobacteriaceae, and Achromobacter. Unidentified fermenters, yeasts, and strains of Flavobacterium, Micrococcus, and Bacillus were found also. In each group, two or three biotypes predominated. Flagellar arrangements and biochemical characteristics are presented for the major groups of Gram-negative bacteria isolated. The majority of cultures required sea water for growth, and grew preferentially at 20 C. Relationships between these data and studies of the intestinal microflora of other marine fish are discussed. Generic and physiological similarities and differences as well as taxonomic difficulties encountered are considered. (Authors)

15151. Hatfield, C. T., and P. H. Johansen (Dept. of Biol., Queen's Univ., Kingston, Ontario, Canada). 1972. EFFECTS OF FOUR INSECTICIDES ON THE ABILITY OF ATLANTIC SALMON PARR (Salmo salar) TO LEARN AND RETAIN A SIMPLE CONDITIONED RESPONSE. J. Fish. Res. Bd. Canada, 29(3): 315-321.

The learning ability of untreated, acetone-treated, and insecticide-treated Atlantic salmon parr was determined in a shuttlebox conditioning apparatus. Learning improvement on second conditioning was also tested. The results were that: (1) acetone did not affect learning; (2) with treatment for 24 hr at the 96-hr LC50 Sumithion completely inhibited learning, Abate retarded learning, DDT mildly enhanced learning, and methoxychlor was without a detectable effect; (3) when Abate and methoxychlor-treated salmon in item (2) above were retrained 1 or 7 days later their learning ability improved; but DDT-treated fish showed no improvement; (4) four days of recovery from a 24-hr exposure to the 96-hr LC50 of Abate or Sumithion still resulted in slow learning ability, although after 7 days of recovery learning rate was the same as that of controls; (5) insecticide treatment at the 96-hr LC50 level for 24 hr interposed between first and second conditioning had little or no effect on learning ability; (6) insecticide concentrations at one-tenth the 96-hr LC50 or lower had no effect on learning ability. (Authors)

15152. Smith, Charlie E., and Robert G. Piper (U. S. Bur. of Sport Fish. and Wildl., Fish Cultural Development Center, Bozeman, Montana 59715). 1972. PATHOLOGICAL EFFECTS IN FORMALIN-TREATED RAINBOW TROUT (Salmo gairdneri). J. Fish. Res. Bd. Canada, 29(3): 328-329.

When rainbow trout (Salmo gairdneri) were exposed to 167 and 250 ppm formalin for 1 hr, moribund fish showed severe histopathological changes in gill epithelium. Hematocrit values and numbers of immature red blood cells were increased, suggesting a physiological response to hypoxia. The results are discussed in relation to the probable cause of death. (Authors)

15153. Gee, John H., and Kazimierz Machniak (Dept. of Zool., Univ. of Manitoba, Winnipeg, Manitoba, Canada). 1972. ECOLOGICAL NOTES ON A LAKE-DWELLING POPULATION OF LONGNOSE DACE (Rhinichthys cataractae). J. Fish. Res. Bd. Canada, 29(3): 330-332.

Longnose dace were found from early July to September in onshore waters on the east side of Hecla Island in the southern basin of Lake Winnipeg. They were most abundant on rocky substrates, where they spawned in early July. It is suggested that at other times of the year these fish occupy deep channels between islands where current is present. While in onshore waters fish less than 5 g adjusted their buoyancy by altering swimbladder volume in response to presence or absence of wave action. Swimbladder volume was similar to that of river-dwelling populations of this species. (Authors)

15154. Forrester, C. R., Alex E. Peden, and R. M. Wilson (Fish. Res. Bd. of Canada Biol. Sta., Nanaimo, British Columbia, Canada). 1972. FIRST RECORDS OF THE STRIPED BASS, Morone saxatilis, IN BRITISH COLUMBIA WATERS. J. Fish. Res. Bd. Canada, 29(3): 337-339.

Two specimens of the striped bass (Morone saxatilis) were taken in British Columbia waters in 1971. One was taken off Port San Juan (48°30'N, 124°30'W) and one in Barkley Sound (48°58'N, 125°03'W). Previous most northerly published record for the Pacific coast was from Puget Sound, Washington. (Authors)

15155. Ennis, G. P. (Fish. Res. Bd. of Canada, Biol. Sta., St. John's, Newfoundland, Canada). 1972. A DIVER-OPERATED PLANKTON COLLECTOR. J. Fish. Res. Bd. Canada, 29(3): 341-343.

A plankton collecting apparatus was devised by strapping together two diver-towing vehicles and mounting a 50-cm plankton net ahead of them. It can be operated at the surface by a snorkel diver or under water by a scuba diver. (Auth.)

15156. Petersson, Ake. 1971. THE Cestoda FAUNA OF THE GENUS Coregonus IN SWEDEN. Institute of Freshwater Research, Drottningholm, Sweden, Report No. 51, pp. 124-183.

15157. White, W. J., and R. J. Beamish (Dept. of Zool., Univ. of Toronto, Toronto, Ontario, Canada). 1972. A SIMPLE FISH TAG SUITABLE FOR LONG-TERM MARKING EXPERIMENTS. J. Fish. Res. Bd. Canada, 29(3): 339-341.

A simple, inexpensive fish tag that allows for growth of the fish is described. Growth rates of smallmouth bass were not significantly affected by tagging. The rate of retention on smallmouth bass was much higher than that for a tag described by Fraser but rates of retention of the two tags on largemouth bass were not significantly different. Estimated rates of tag loss were 15% after 1 year for smallmouth bass and 17% after 3 years for largemouth bass. Observed tag losses from white suckers over 3 years were only 0.6%. Using this method, two or three persons can conveniently tag fish at a rate of approximately 30 per hour. (Authors)

15158. Cala, Plutarco (Dept. of Animal Ecol., Univ. of Lund, Lund, Sweden). 1971. SIZE AND AGE AT MATURITY, RIPENING AND FECUNDITY OF THE IDE Idus idus (L.). Inst. of Freshwater Research, Drottningholm, Sweden, Report No. 51, pp. 31-46.

An examination of size and age at maturity, ripening and fecundity was made of ide from the lower part of River Kävlingeån from November 1964 to spring 1967. Fish with well developed gonads apparently capable of producing gametes during the current year were considered to be mature. All ide shorter than 31.5 cm in total length were immature, and all longer than 43.1 cm were mature. The shortest mature male was 39.2 cm long. All males were mature at lengths greater than 40.1 cm. The first mature females appeared at 30.9 - 32.8 cm (shortest mature individual measured 31.5 cm). All females longer than 43.1 cm were mature. Males reached 100% maturity at a length 3 cm less than the females. All ide younger than age group VI were immature and all older than the VII age group were mature. All males older than age group VI were mature. Ripening females (2 weeks before the spawning) contained eggs in three stages of development: 1 a) unripe: 100-250 μm diameter, clear, nucleated egg cells; 1b) unripe: 300-500 μm diameter, oil globule vaguely discernible, especially in the largest ova, egg with clouded appearance; 2) ripening: 0.5-1.3 mm diameter; and 3) ripe: 1.30-1.85 mm diameter, mean 1.50. The eggs ready to be laid and fertilized have a mean diameter of about 1.70 mm. 24 hours after the eggs have been deposited they have a mean diameter of about 2.3 mm. Females that would be ripe in April (spawning time) can be distinguished from immature females as early as in the previous July on the basis of examining the mean diameter of 30 of the largest ova. The largest increase in diameter of the ova occurs in August when the eggs have reached a mean diameter of about 1.30 mm in the middle of the month. In November the ova have the size that they have just prior to spawning or when the egg becomes ripe. The higher the ripening index, the higher the degree of ripeness. There is some evidence that the males ripen earlier in the season than the females do. It further seems that older (or larger) fish ripen earlier in the season than do those which are smaller or spawn by the first time. This is in accordance with the first appearance of the males on spawning grounds and also with the fact that the largest ide spawn first (Cala 1970 a). The total numbers of ripe eggs ranged between 42,279 - 263,412, approximate mean 122,000. A scatter diagram of the number of eggs plotted against the total length of the fish gives a relation expressed by the formula: $\log F = -3.63017 \pm 3.4358 \log L$. The relation of body weight can be described by a straight line, with the mean number of eggs increasing from approximately 30,000 for a 500 g female to about 193,000 for a 2,000 g female, i.e. the fecundity increased by about 53,000 eggs for each increase of body weight of 0.5 kg within the range 0.5-2 kg. This relation is expressed by the formula: $F = -25.4262 + 0.1094 W$ (F = number of eggs and W = body weight). A similar relation was made of the number of ripe ova to the age and to the total weight of the ovary of the fish. The linear relations were expressed by the formula: $F = -99.6154 + 25.2074 A$ and $F = 44.5508 + 0.2721 X$ where F = number of eggs, A = age of the fish and X = weight of the ovary. (Auth. summ.)

15159. Höglund, Lars B., and Hans Borjeson (Inst. of Zoophysiol., Univ. of Uppsala, Sweden). 1971. ACIDITY AND LACTATE CONTENT IN THE BLOOD OF YOUNG ATLANTIC SALMON (Salmo salar L.) EXPOSED TO HIGH pCO_2. Inst. of Freshwater Research, Drottningholm, Sweden, Report No. 51, pp. 67-74.

The present study is concerned with the transitory changes of pH and lactate content in the blood of young salmon (Salmo salar L.) in response to raised pCO_2 in the ambient water. An effective acid-base regulation was found to counteract a pronounced acidosis induced by a sudden rise of pCO_2 in the ambient water. The acidosis is not correlated to any significant changes of blood lactate. (Authors summ.)

15160. Höglund, Lars B., and Anders Persson (Inst. of Zoophysiol., Univ. of Uppsala, Sweden). 1971. EFFECTS OF LOCOMOTOR RESTRAINT AND OF ANAESTHESIA WITH URETHANE OR MS-222 ON THE REACTIONS OF YOUNG SALMON (Salmo salar L.) TO ENVIRONMENTAL FLUCTUATIONS OF pH AND CARBON DIOXIDE TENSION. Inst. of Freshwater Research, Drottningholm, Sweden, Report No. 51, pp. 75-89.

Second-summer salmon parr whose movements were restrained were compared with those which were allowed to move freely, each in their respective compartments (10 X 15 X 20 cm) of a test chamber, with respect to their response to changes of pH and pCO_2 in the ambient water. Both fish remained calm in a constant flow of aerated, bicarbonate-rich Uppsala water. Short periods (40 min) of identical pH/pCO_2 variations (pH between 7.5 and 6.8 and pCO_2 between 5 and 30 mm Hg), which were repeated at regular intervals (40 min or 24 hours), induced well reproducible body movements - fluttering movements within the restraining device in the first case and excited swimming in the second - and hyperventilation. The maximal ventilation during a CO_2 test period was higher in the fish that was allowed to swim. The importance for the ventilation rate of variations in the ambient carbon dioxide tension and of an assumed difference in accumulation of endogenous carbon dioxide with the different types of movements is discussed. The degree and duration of reflex disturbances induced by urethane or MS-222 were studied in unrestrained fish by repeated CO_2- response tests. (Authors summ.)

15161. Nilsson, Nils-Arvid, and Olof Filipsson. 1971. CHARACTERISTICS OF TWO DISCRETE POPULATIONS OF ARCTIC CHAR (Salvelinus alpinus L.) IN A NORTH SWEDISH LAKE. Inst. of Freshwater Research, Drottningholm, Sweden, Report No. 51, pp. 90-108.

Several subpopulations of arctic char have long been recognized in Scandinavia both by local fishermen and by biologists. A description is given of two populations in a lake in southern Swedish Lappland, here referred to as "ordinary char" and "blattjen". The two forms of char could be distinguished from the shape of their otoliths, one type being characterized as "arrow-shaped" (ordinary char), the other as "drop-shaped" (blattjen). A slight difference in gillraker counts of the two populations could be discerned, but none for pyloric caeca. Coloration of the two populations at spawning time is different, as is also flesh coloration in autumn. Most "ordinary char" were caught with floated gill nets in the pelagic, most "blattjen" with sinking nets in the littoral region of the lake. In autumn "ordinary char" fed on planktonic Crustacea, mainly Daphnia, while "blattjen" fed on bottom animals, mainly Gammarus. Even fish that were all caught at the same stations in the littoral region displayed a similar food segregation. There is a highly significant difference in growth rate between the two forms, the "ordinary char" being more fast-growing than the "blattjen". "Ordinary char" caught with sinking gill nets as well as "blattjen" display a greater variability in growth rate than do char caught with floated nets. A greater fraction of the stomachs of the "ordinary char" had a high degree of filling as compared with "blattjen". It is suggested that differences in stomach fullness as well as in growth rates results from a more severe competition between brown trout and "blattjen". There was evident difference in the average size of the spawning fish belonging to the different populations, the "blattjen" being smaller at maturity. On the other hand, they were on average older than the "ordinary char" at maturity. The authors regard the two populations as being separate species. Although here are many parallels with the char populations of other lakes in Scandinavia, further analysis is needed before detailed generalizations as to the whole complex can be made. (Authors summ.)

15162. Nyman, Lennart (Fish. Res. Bd. of Canada, Biol. Sta., St. John's, Newfoundland, Canada). 1971. PLASMA ESTERASES OF SOME MARINE AND ANADROMOUS TELEOSTS AND THEIR APPLICATION IN BIOCHEMICAL SYSTEMATICS. Inst. of Freshwater Research, Drottningholm, Sweden, Report No. 51, pp. 109-123.

This paper presents a survey of the serum esterases of 35 species of marine and anadromous fish. With few exceptions these enzymes appear to be species specific and agree with classical taxonomy. Also, certain trends in the phylogeny of the taxa involved are indicated, which clearly illustrate the differential rates of evolution among taxa at the same category level and the different modes of genetic changes that may occur. According to inhibition studies and substrate specificity the serum esterases of these marine teleosts can be classified more specifically as carboxylesterases (formerly aliesterases; EC 3.1.1.1 carboxylic ester hydrolase) with a selective affinity toward alpha-isomers of naphthyl acetate and naphthyl propionate. (Auth. summ.)

15163. The Inland Fisheries Trust Incorporated (Dublin, Ireland). 1972. ANNUAL REPORT 1971/72. To the 22nd Ann. Gen. Meeting of The Inland Fisheries Trust Incorporated on 10 May, 1972, 96 p.

Over 45,000 pike weighing almost 23 tons and 450,000 adult perch (42 tons), as well as 7 tons of perch spawn, were removed from lakes and rivers being developed as trout fisheries. Nearly 3-1/2 million trout ova were handled at our hatcheries, yielding a total of 2-1/2 million fry, fingerling and yearling trout. Coarse fishing surveys to assess potential were undertaken on 22 new waters at 13 centers. General surveys and investigations were made of 35 new waters to ascertain their suitability for future development as trout or coarse fisheries. Investigations into the presence, movements and habits of porbeagle and blue sharks were continued on the West coast during the season. This was combined with general boat surveys to find new angling grounds. Diseased trout were reported from a number of waters during the recent spawning season. Spawning trout are subject to a variety of diseases which are difficult to diagnose. In some cases "marked" fish were diagnosed as having U.D.N. and in others as having spawning mycosis.

15164. FAO of the United Nations (Rome, Italy). 1971. FAO AQUACULTURE BULLETIN. A QUARTERLY NEWS DIGEST OF AQUACULTURE RESEARCH AND DEVELOPMENT. FAO Aquacult. Bull., 4(1): 24 p., illus.

Contents include: From research institutions ... Induced breeding of the giant goby - Induced spawning of milkfish - A culture system for marine fish larvae - Polyculture in brackish waters - Trout culture - Acoustic attractor for trout hybrids - Tuna culture - Shrimp culture - Oyster culture - Rotatable cage for high-density aquaculture - Environmental manipulation - Ultraviolet sterilization for algal culture. Aquaculture development ... Australia - China (Taiwan) - Hong Kong - Hungary - India - Indonesia - Iran - Italy - Japan - New Zealand - Peru - Philippines - Poland - South Africa - Thailand - United States - U.S.S.R. Fish diseases and their control ... Furunculosis - Disinfection of eggs - Diseases of grass carp - Hematocrit value and resistance of carp to dropsy - Effect of stress on trout and salmon - Oyster disease in France - Necrosis in shrimp - Disease of cultivated catfish in Thailand. Fish and shellfish introductions ... Recent introductions - Pangasius sutchi in China (Taiwan) - Fish introductions in Ecuador - The giant freshwater prawn in Japan. (From contents)

15165. LaRoche, Gilles, Ronald Eisler, and Clarence M. Tarzwell (Nat. Marine Water Qual. Lab., Federal Water Qual. Admn., West Kingston, Rhode Island). 1970. BIOASSAY PROCEDURES FOR OIL AND OIL DISPERSANT TOXICITY EVALUATION. J. Wat. Poll. Contr. Fed., 42(11): 1982-1989.

Laboratory procedures are listed for the determination of relative 96-hr toxicities of crude oils, oil-spill removers, and oil-dispersant mixtures to representative cyprinodontiform teleosts, polychaete annelids, and decapod crustaceans. Salient features of the method include the use of disposable glassware, a synthetic seawater formulation, high-speed reciprocating shakers, controlled aeration, and DSS as a reference toxicant. The method may be used to test any product for toxicity to appropriate organisms in media of any salinity. (Authors summ.)

15166. Erickson, S. J., T. E. Maloney, and J. H. Gentile (Fed. Water Qual. Admn., Nat. Mar. Water Qual. Lab., West Kingston, Rhode Island). 1970. EFFECT OF NITRILOTRIACETIC ACID ON THE GROWTH AND METABOLISM OF ESTUARINE PHYTOPLANKTON. J. Wat. Poll. Contr. Fed., 42(8), Part 2, pp. R329-R335.

The results of this study indicate that NTA is of relatively low toxicity to estuarine phytoplankton and that high concentrations of NTA can be tolerated as long as the chelate to metals ratio is favorable. In seawater, the whole NTA molecule is likely to produce trace metals deficiency at relatively low concentrations. In our experiments, phytoplankton were unable to directly metabolize NTA. Marine bacteria, however, are able to metabolize NTA and the residence time because the whole molecule in an estuary would be expected to be short. End products of NTA degradation in sufficient quantities are likely to promote algal blooms. (Authors summ.)

15167. Zillioux, E. J., and N. F. Lackie (Univ. of Miami, Rosenstiel School of Mar. and Atmospheric Sciences, Miami, Florida). 1970. ADVANCES IN THE CONTINUOUS CULTURE OF PLANKTONIC COPEPODS. Helgoländer wiss. Meeresunters. 20, 325-332.

Construction modifications which improve the efficiency and broaden the versatility of a recirculating culture system for planktonic copepods are described. Folin protein, dissolved organic carbon and particle content have been measured to determine relative efficiencies of two foam towers under different conditions. A combined settling and filtration tank has been designed to facilitate flow-through adaptation of the culture system. (Authors summ.)

15168. Gardner, George R., and Paul P. Yevich. 1969. TOXICOLOGICAL EFFECTS OF CADMIUM ON Fundulus heteroclitus UNDER VARIOUS OXYGEN, pH, SALINITY AND TEMPERATURE REGIMES. American Zoologist, 9(4): 1096.

Preliminary studies on the histopathological responses of the common mummichog (Fundulus heteroclitus) to acute cadmium poisoning have shown changes in the intestinal tract, in the kidney and in the blood as indicated by a rise in the percentage of eosinophils from control values avaraging 3% to an average 43% for exposed fish. Under conditions of 30 °/oo salinity, pH 7.8, dissolved O_2 at approximately 7 mg/l, a temperature of 20°C, and a monitored cadmium concentration of 50 ppm, lesions occurred in the intestine after one hour of exposure and after eight hours in the kidney. Under these conditions eosinophilia is observed in the peripheral blood after eight hours of exposure. Similar findings were obtained in specimens exposed to the relatively high cadmium concentration while a single environmental parameter was modified and others maintained constant. In one experiment the salinity was decreased to 15 °/oo, in a second the pH was maintained at 4, in a third the temperature was raised to 30°C (oxygen maintained at saturation 4.5 mg/liter) and in a fourth experiment the oxygen content was reduced to 2 mg/liter while all other parameters remained constant. Although the same lesions were produced the rate and order of incidence were altered. Kidney lesions occurred in nearly all animals, except in those exposed under low pH conditions where only 10% showed the lesions. Intestinal lesions were present in all animals exposed under low oxygen levels, and in approximately 50% of those exposed under the temperature and salinity environmental modifications. The incidence of intestinal lesions (19%) were least under conditions of low pH. All specimens exposed showed severe eosinophilia (over 43% rise in eosinophil counts) except at 30°C in which an average rise of 30% in eosinophils was observed. Although the sequence and degree of morphological events leading to a toxicological response of F. heteroclitus to cadmium may be altered by changes in environmental conditions, the histopathological and hematological changes remain undistinguishable to those observed under the prevalent environmental conditions of sea water.

15169. Etnier, David A. (Dept. of Zool. and Entomol., Univ. of Tenn., Knoxville, Tennessee 37916). 1972. THE EFFECT OF ANNUAL RECHANNELING ON A STREAM FISH POPULATION. Trans. Amer. Fish. Soc., 101(2): 372-375.

15170. Zillioux, E. J. (Fed. Water Qual. Admn., Nat. Mar. Water Qual. Lab., West Kingston, Rhode Island). 1969. A CONTINUOUS RECIRCULATING CULTURE SYSTEM FOR PLANKTONIC COPEPODS. Marine Biology, 4(3): 215-218.

The calanoid copepods, Acartia clausi Giesbrecht and Acartia tonsa Dana, are maintained at high densities in continuous culture at 15°C. Synthetic sea-water medium is recirculated through filters and a foam tower which limits accumulation of dissolved wastes and various metabolites. The ciliate Euplotes vannus Müller is associated in culture with the copepods, and effectively controls bacterial population and accumulation of algal debris. The copepods graze upon the ciliates as well as upon the phytoflagellates Isochrysis galbana Parke and Rhodomonas baltica Korsten. (Auth.)

15171. Siefert, Richard E. (Environ. Protection Agency, Nat. Water Qual. Lab., Duluth, Minnesota 55804). 1972. FIRST FOOD OF LARVAL YELLOW PERCH, WHITE SUCKER, BLUEGILL, EMERALD SHINER, AND RAINBOW SMELT. Trans. Amer. Fish. Soc., 101(2): 219-225.

Entire digestive tract contents from larval yellow perch [Perca flavescens (Mitchill)], white sucker [Catostomus commersoni (Lacépède)], bluegill (Lepomis macrochirus Rafinesque), emerald shiner (Notropis atherinoides Rafinesque), and rainbow smelt [Osmerus mordax (Mitchill)], along with plankton samples taken concurrently with fish samples, were identified and counted. Food selection was calculated by use of Ivlev's electivity index. First food of yellow perch from an eutrophic lake were copepod nauplii and cyclopoid copepods; after fish reached 11 mm in length Bosmina coregoni was the dominant food. Yellow perch from an oligotrophic lake fed first on the rotifer Polyarthra, and to a lesser extent on copepod nauplii; after fish reached 11 mm cyclopoid copepods became the most important food items. Rotifers contributed an important portion of the early diet of white sucker; copepod nauplii and Cyclops bicuspidatus provided the remainder of the diet. Cladocerans increased in numbers after the fish reached 14 mm. Food of bluegills at the initiation of feeding consisted of Polyarthra and copepod nauplii. When fish reached 7 mm other rotifers and cyclopoid copepods appeared in the diet, and at 8 mm cladocerans become the dominant food and remained so for larger fish. Rotifers, mainly Trichocera, were the dominant food of first-feeding emerald shiners, and they remained an important food of larger fish. Copepod nauplii became a dominant food when fish reached 10 mm, and Cyclops bicuspidatus and cladocerans were important foods in fish 7 mm and larger. Algae were found in fish of all sizes, and calanoid copepods were found in fish 13 mm and larger. First-feeding rainbow smelt contained Cyclops bicuspidatus, copepod nauplii, diatoms, and green algae; C. bicuspidatus was the principal food until fish reached 21 mm. Calanoid copepods succeeded as the dominant food for larger fish. Electivity indices showed the following to be highly selected prey of fish at the initiation of feeding: yellow perch - Polyarthra and cyclopoid copepods; bluegill - Polyarthra; emerald shiner - rotifers and copepod nauplii; and rainbow smelt - Cyclops bicuspidatus and copepod nauplii. Selection of food among the fish species studied was similar. Necessary criteria of a desirable prey include small size, the inability to escape capture, close proximity to the predator, and probably attraction of the predator by swimming movements. (Auth.)

15172. Miller, Robert Rush (Museum of Zool., The Univ. of Mich., Ann Arbor, Michigan). 1972. THREATENED FRESHWATER FISHES OF THE UNITED STATES. Trans. Amer. Fish. Soc., 101(2): 239-252.

Threatened, native freshwater fishes are listed for 49 of the 50 U. S. States, the first such compilation. Over 300 kinds are included in a formal classification, cross-indexed to states, followed by state lists and the status of each fish, whether rare, endangered, depleted, or undetermined. The concern for native fishes and the important factors responsible for threats to their existence are briefly outlined. Although the lists vary from those based on extensive recent state surveys to others in which current information is sparse, publication is expected to enhance the chances for survival through protective legislation (already enacted by a number of states) and stronger concern for such natural resources. (Auth.)

15173. Smith, Wesley E. (U. S. Environ. Protection Agency, Nat. Wat. Qual. Lab., 6201 Congdon Blvd., Duluth, Minnesota 55804). 1972. CULTURE, REPRODUCTION, AND TEMPERATURE TOLERANCE OF Pontoporeia affinis IN THE LABORATORY. Trans. Amer. Fish. Soc., 101(2): 253-256.

Pontoporeia affinis was maintained in the laboratory at 6 C for over 3 months, during which time the animals reproduced successfully. They appeared to require a silty substrate into which they could burrow, and any marked circulation or agitation of the water had an adverse effect upon them. A mixture of a powdered egg-yolk preparation and dehydrated cereal-grass leaf powder was the most successful food source. Temperature tolerance tests resulted in a 24-hr TLm of 12 C, a 96-hr TLm of 10.8 C, and a 30-day TLm of 10.4 C. (Auth.)

15174. Carline, Robert F. (Wisconsin Dept. of Nat. Resources, Hartman Creek Waupaca, Wisconsin 54981). 1972. BIASED HARVEST ESTIMATES FROM A POSTAL SURVEY OF A SPORT FISHERY. Trans. Amer. Fish. Soc., 101(2): 262-266.

A partial creel census and a postal card survey were simultaneously employed to determine the harvest of wild brook trout (Salvelinus fontinalis) from several ponds. A comparison of the catch per effort ratios (c/e) from interviews and postcards revealed a positive bias in the estimates obtained from returned postcards. The c/e ratios from postcards were double the c/e ratios from interviews. This discrepancy was partly due to the reluctance of unsuccessful anglers to return postcards. There was a significantly higher proportion of unsuccessful anglers from interviews than from postcard returns. Positive errors in the c/e ratios also resulted from a nonresponse of successful anglers and from more than one fisherman reporting on a single card. Estimates of fishing success from postcards seriously overestimated the season's harvest of trout and the exploitation rates. (Auth.)

15175. Amend, Donald F., and John P. Pietsch (Bur. of Sport Fish. and Wildl., Western Fish Disease Lab., Seattle, Washington 98115). 1972. AN IMPROVED METHOD FOR ISOLATING VIRUSES FROM ASYMPTOMATIC CARRIER FISH. Trans. Amer. Fish. Soc., 101(2): 267-269.

This paper describes a method using elevated levels of penicillin, streptomycin, and nystatin instead of filters to control bacteria and mold contaminants in specimens processed for virus isolation. Filters were shown to significantly reduce the virus concentration. Virus and tissue cultures were not affected by this procedure. In field tests nearly three times more specimens were positive for virus with this method than with the widely used filter technique. Moreover, the cost of materials was less. This method is recommended for inspection and certification purposes. (Authors)

15176. Kaya, Calvin M., and Arthur D. Hasler (Lab. of Limnol., Dept. of Zool., Univ. of Wis., Madison, Wisconsin 53706). 1972. PHOTOPERIOD AND TEMPERATURE EFFECTS ON THE GONADS OF GREEN SUNFISH, Lepomis cyanellus (Rafinesque), DURING THE QUIESCENT, WINTER PHASE OF ITS ANNUAL SEXUAL CYCLE. Trans. Amer. Fish. Soc., 101(2): 270-275.

Gonadal maturation normally occurs in green sunfish during spring, under long daylengths and elevated water temperatures. Experiments on fish with regressed gonads during winter indicate that gonadal recrudescence is stimulated in both sexes of this species only by a combination of both elevated water temperatures (>15C) and long (artificial) photoperiod (15 hr). This suggests that the natural appearance of this combination of stimuli during spring is essential for stimulating the maturation of green sunfish gonads at this time of the year. (Authors)

15177. Bearden, Charles M., and Michael D. McKenzie (S. C. Wildl. Res. Dept., Marine Resources Div., Charleston, South Carolina 29412). 1972. RESULTS OF A PILOT SHRIMP TAGGING PROJECT USING INTERNAL ANCHOR TAGS. Trans. Amer. Fish. Soc., 101(2): 358-362.

15178. Heard, William R. (NMFS, Auke Bay Fisheries, Auke Bay, Alaska 99821). 1972. SPAWNING BEHAVIOR OF PINK SALMON ON AN ARTIFICIAL REDD. Trans. Amer. Fish. Soc., 101(2): 276-283.

The spawning behavior of pink salmon (Oncorhynchus gorbuscha) was observed and photographed through a glass viewing port in the bottom of an artificial redd in an observation tank. Females readily accepted the artificial redd and completed the normal prespawning behavior sequences, including redd defense, digging, and crouching, but did not complete the spawning act and extrude eggs. Males, however, frequently followed the courtship sequence through to milt ejections. In 14 incomplete spawning acts, milt was ejected by males but eggs were not released by females. Seven of these acts involved the same male, over a 9-day period. Failure of females to extrude eggs was attributed to some unknown limiting physical condition of the redd or tank - possibly the smooth surface of the viewing port in the redd. (Auth.)

15179. Jahn, Lawrence A. (Dept. of Biol. Sci., Western Ill. Univ., Macomb, Illinois). 1972. DEVELOPMENT OF THE OLFACTORY APPARATUS OF THE CUTTHROAT TROUT. Trans. Amer. Fish. Soc., 101(2): 284-289.

The development of the olfactory structures of embryos, fry, fingerling, juvenile and adult cutthroat trout was determined by histological and dissection techniques. Fish examined 20 days after fertilization (15 days before hatching) had nerve cells present in the olfactory epithelium and nerve fibers entering the brain. Lamellae developed on alternate sides of the central raphe in each rosette. Adult olfactory epithelium contained neuroepithelial, mucous, supporting, and basal cells with neuroepithelial cells present only in the valleys of the lamellae. Water circulation through the olfactory organ appeared to be inactive, although two accessory chambers were present. The structural components necessary for olfaction were present well before the fish leave their homestreams. Imprinting to a homestream odor is a possibility at a very early age. (Auth.)

15180. Schaaf, W. E., and G. R. Huntsman (NMFS, Atlantic Estuarine Fisheries Center, Beaufort, North Carolina 28516). 1972. EFFECTS OF FISHING ON THE ATLANTIC MENHADEN STOCK: 1955-1969. Trans. Amer. Fish. Soc., 101(2): 290-297.

To determine the effect of purse-seine fishing on the Atlantic menhaden (Brevoortia tyrannus) population, we analyzed data from 1955-69 on fishing activity and catches. Changes in fishing efficiency necessitated establishment of an abstract effort unit, the 1965 vessel-week. Catch per unit of effective effort in 1965 was one-fifth that of 1955. Our instantaneous natural mortality rate (M) estimate was 0.37. At the current recruitment age, 1.5 years, reducing F, instantaneous fishing mortality, to about 0.8 would slightly decrease the yield per recruit, but would increase the spawning stock and ultimately allow annual catches of 400,000-500,000 metric tons, the maximum sustained yield. (Authors)

15181. Merna, James W., Michael E. Bender, and James R. Novy (Inst. for Fish. Res., Mich. Dept. of Natural Resources, Ann Arbor, Michigan). 1972. THE EFFECTS OF METHOXYCHLOR ON FISHES. I. ACUTE TOXICITY AND BREAKDOWN STUDIES. Trans. Amer. Fish. Soc., 101(2): 298-301.

The rate of breakdown of methoxychlor in water varies considerably with the water source. The half life attributable to hydrolysis in distilled water exceeds 200 days, whereas the half life may be as short as one day in water of high biological activity. Static toxicity studies were found to be unreliable due to the rapid breakdown of methoxychlor. Continuous flow studies yielded TL_{50} values of 7.5 μg/l for fathead minnows and 20 μg/l for yellow perch. These values are considerably lower than others given in the literature. The difference is probably due to the use of a wetting agent to achieve better solution of methoxychlor. (Authors)

15182. Timms, A. M., and H. Kleerekoper (Dept. of Biol., Texas A&M Univ., College Station, Texas 77843). 1972. THE LOCOMOTOR RESPONSES OF MALE Ictalurus punctatus, THE CHANNEL CATFISH, TO A PHEROMONE RELEASED BY THE RIPE FEMALE OF THE SPECIES. Trans. Amer. Fish. Soc., 101(2): 302-310.

The monitoring of the locomotor movements of ripe male channel catfish (Ictalurus punctatus) in response to a sexual pheromone released by a ripe female of the species demonstrated a very strong attraction to the source. The specific locomotor responses exhibited in different experimental conditions strongly supported the conclusion that, when the stimulus was at appropriate strength, tropotaxis was the orienting mechanism. When the pheromone was introduced at a point source, the tenacity of the male's response diminished gradually as the relative concentration of the pheromone was decreased, resulting in more widely dispersed locomotor movements which were indicative of "searching" behavior or "alarm" response. When confronted with two point sources of the pheromone of different strengths in an open field, the male was not attracted preferentially by the stronger. (Authors)

15183. Walburg, Charles H. (Bur. of Sport Fish. and Wildl., No. Central Reservoir Investigations, Yankton, South Dakota 57078). 1972. SOME FACTORS ASSOCIATED WITH FLUCTUATION IN YEAR-CLASS STRENGTH OF SAUGER, LEWIS AND CLARK LAKE, SOUTH DAKOTA. Trans. Amer. Fish. Soc., 101(2): 311-316.

The strength of sauger, Stizostedion canadense (Smith), year classes in Lewis and Clark Lake has fluctuated widely since formation of the reservoir in 1956. Our studies suggest that more than 80% of the variability in year-class strength measured from the catch of fish older than age 0 can be predicted from knowledge of water level change over the spawning ground, June reservoir water temperature, and reservoir water exchange rate. These factors were measured and probably function during the first 2 months of fish life. Sauger year classes of better than average strength can be expected in most years if both power-peaking operations at Fort Randall Dam during the fish spawning and incubation period, and the reservoir water exchange rate during June are minimized. (Auth.)

15184. McCann, John A., and Robert L. Jasper (Pesticides Regulation Div., Environ. Protection Agency, Agric. Res. Center, Beltsville, Maryland 20705). 1972. VERTEBRAL DAMAGE TO BLUEGILLS EXPOSED TO ACUTELY TOXIC LEVELS OF PESTICIDES. Trans. Amer. Fish. Soc., 101(2): 317-322.

Bluegill fingerlings, Lepomis macrochirus, exposed to six different pesticide formulations, developed hemorrhaging and fractures of the caudal vertebrae 4 to 8 hours after treatment. Fish exposed to Dyrene® Akton®, methyl parathion, trichlorfon, phosalone and demeton developed vertebral injury. Injury was observed at concentrations above and below the LC_{50} for each chemical. Disturbance of fish during the early hours of exposure increased mortality and hemorrhage rates. (Use of trade names does not constitute endorsement by the U. S. Environmental Protection Agency). (Authors)

15185. Derr, S. Krogh, and Matthew J. Zabik (Dept. of Entomol.-Pesticide Res. Center, Mich. State Univ., East Lansing, Michigan 48823). 1972. BIOLOGICALLY ACTIVE COMPOUNDS IN THE AQUATIC ENVIRONMENT: THE UPTAKE AND DISTRIBUTION OF [1,1-DICHLORO-2,2-BIS (P-CHLOROPHENYL) ETHYLENE], DDE BY Chironomus tentans Fabricius (DIPTERA: CHIRONOMIDAE). Trans. Amer. Fish. Soc., 101(2): 323-329.

The midge, Chironomus tentans, was exposed from egg through adult to varying concentrations (.07 to 2.2 ppb) of [1,1-dichloro-2.2-bis (p-chlorophenyl) ethylene], DDE. The amount of DDE accumulated by the midge was determined by gas-liquid chromatography. The accumulation of DDE from aqueous solution and contaminated substrate by the midge as a function of DDE concentration and exposure time was determined, and the distribution of the accumulated DDE residue was quantitated (pupa, exuvia, adult, and egg mass). No attempt was made to differentiate between these two modes of uptake (water or substrate). The DDE

accumulation by the midge demonstrated a dose-dependent relationship, accumulating DDE exponentially with increased concentration at a given exposure time. At any given concentration of DDE in the water, accumulation increased with increased exposure time. On a ppm basis the midges concentrated DDE approximately 20,000 times over that level which was present in the water. The exuvia did not demonstrate a major route of residue elimination as only 1.4 to 4.9% of the pupal burden was lost via the exuviae. The process of egg deposition eliminated 11.6 to 30.9% of the adult female burden of DDE residue. (Authors)

15186. Gibson, H. R., and D. W. Chapman (Idaho Coop. Fish. Unit, Univ. of Idaho, Moscow, Idaho). 1972. EFFECTS OF ZECTRAN INSECTICIDE ON AQUATIC ORGANISMS IN BEAR VALLEY CREEK, IDAHO. Trans. Amer. Fish. Soc., 101(2): 330-344.

We assessed effects of the experimental insecticide Zectran® on aquatic organisms in Bear Valley Creek, Idaho in 1966. Hayden Creek drainage, nearby and not sprayed, served as a control. We found no significant fish mortality, and no effect on growth rate and condition of age 0+, 1+, 2+, and 3+ dolly varden (Salvelinus malma). Insecticide applications did not increase emigration and intrastream movement of fish. We noted no effects on benthic aquatic insect numbers, but observed that more insects drifted downstream for several hours beginning about 3 hours after spraying on 7 July 1966. Adult terrestrial insects, immature Heptageneidae and Rhyacophilidae, adult Chloroperlidae, and immature and adult Phryganeidae, Limnephilidae, and Blephariceridae increased in drift samples after spraying. We concluded that Zectran insecticide damaged aquatic organisms very little. (Authors)

15187. McClendon, Emmitt L., and William E. Schafer (Inland Fish. Branch, Calif. Dept. of Fish and Game, Sacramento, California 95814). 1972. EVIDENCE ON THE INFLUENCE OF THE COPEPOD (Salmincola californiensis) ON THE REPRODUCTIVE PERFORMANCE OF A DOMESTICATED STRAIN OF RAINBOW TROUT (Salmo gairdneri). Trans. Amer. Fish. Soc., 101(2): 345-346.

This report is concerned with the egg number and egg size of hatchery-raised rainbow trout before and after eradication of the parasitic copepod Salmincola californiensis. The absence of the expected increase in number of eggs per female with increasing age for copepod-infested brood fish indicates that the parasite reduced the fishes' ability to produce eggs. The presence of the parasitic copepod did not appear to affect egg size.

15188. Hansen, David J. (Environ. Protection Agency, Gulf Breeze Lab., Sabine Island, Gulf Breeze, Florida 32561). 1972. DDT AND MALATHION: EFFECT ON SALINITY SELECTION BY MOSQUITOFISH. Trans. Amer. Fish. Soc., 101(2): 346-350.

The effect of DDT and malathion on salinity selection by mosquitofish, Gambusia affinis was investigated. Of the two pesticides tested, only DDT affected salinity selection by mosquitofish. Mosquitofish exposed to 5, 10, or 20 ppb DDT selected significantly greater (.05 level) salinities than did unexposed fish. (Auth.)

15189. Griswold, Bernard L., and Lloyd L. Smith, Jr. (Dept. of Entomol., Fish., and Wildl., Univ. of Minn., St. Paul, Minnesota 55101). 1972. EARLY SURVIVAL AND GROWTH OF THE NINESPINE STICKLEBACK, Pungitius pungitius. Trans. Amer. Fish. Soc., 101(2): 350-352.

In aquarium studies, average egg mortality in five nests of the ninespine stickleback Pungitius pungitius was 3.4% to the eyed stage (2 days) and 4.2% to hatching (5 days) when all fish but the parent males were removed. Fry mortality was normally very low. Cannibalism was observed among fry and usually resulted in the death of both cannibal and victim. The only period of extensive mortality among fry in the aquaria was when they reached 6.5-7.0 mm total length and each had absorbed its yolk sac. At this time, large numbers did not appear to feed on the plankton provided (copepods, rotifers and brine shrimp) and approximately 50% died. At 12 C, twenty-five larvae from each successful nest had an average length of 5.65 mm at hatching. Similar samples measured 5.95, 6.75, 7.56, 8.64, 10.77 and 12.91 mm after 1, 6, 11, 13, 18, and 22 days respectively.

15190. Erman, Don C. (Bur. of Sport Fish. & Wildl., Yellowstone Fish. Mgmt. Investigations, Yellowstone, Wyoming). 1972. A FISHERMAN SURVEY OF THE MADISON-FIREHOLE RIVERS IN YELLOWSTONE NATIONAL PARK, 1969. Trans. Amer. Fish. Soc., 101(2): 352-355.

Fishermen experienced on the Madison had a mean landing rate of 0.68 fish/hr compared with 0.17 fish/hr for those fishing there for the first time. On the Firehole experienced fishermen had a mean landing rate of 0.77 fish/hr; and newcomers, 0.40 fish/hr. Estimated total catch for 1969 in the Madison was 3,406 fish, a result of 26,710 (± 3,308) hours of fishing. Of the total catch, 70% or an estimated 2,284 fish were brown trout. Rainbow trout accounted for 14.8% of the Madison catch (505 fish), and white fish, 12.6% (426 fish). In the Firehole the total catch was 2,929 fish and total effort was 18,684 (± 2,734) hours. An estimated 1,128 brown trout were caught comprising 38.5% of the Firehole catch, while rainbow trout accounted for 60.7%. Mean lengths of Madison fish were 321 mm for brown trout, 303 mm for rainbow trout, and 338 mm for whitefish. On the Firehole the mean length was 290 mm for brown and rainbow trout. The number of fish kept per hour was 0.13 on the Madison and 0.16 on the Firehole.

15191. Beamish, Richard J. (Dept. of Zool., Univ. of Toronto, Toronto, Canada). 1972. LETHAL pH FOR THE WHITE SUCKER Catostomus commersoni (Lacépède). Trans. Amer. Fish. Soc., 101(2): 355-358.

At low and lethal pH values (3.0-3.8) white suckers initially displayed a short period of extreme activity followed by prolonged periods of inactivity. Prior to loss of equilibrium, activity again increased, as did ventilatory movements. Moreover, fish were coated with a white film. Suckers could not be revived once this film was well formed. At pH 4.2 this film did not develop. When experiments lasted longer than 24 hours, fish ceased feeding. Fish maintained in experiments lasting longer than 24 hours lost weight, became emaciated, and developed muscular and spinal deformities. Death usually resulted several weeks after these symptoms developed. Fish from these experiments could be revived, although they suffered permanent deformities. It appears that the cause of death was not the same at pH values above and below pH 3.9.

15192. McIlwain, T. D., and Richard Waller (Gulf Coast Res. Lab., P. O. Box AG, Ocean Springs, Mississippi 39564). 1972. A XANTHOCHROIC GAR, Lepisosteus oculatus, FROM MISSISSIPPI. Trans. Amer. Fish. Soc., 101(2): 362.

A 389 mm (standard length) xanthochroic Lepisosteus oculatus Winchell was caught on hook and line in Old Fort Bayou near Ocean Springs, Mississippi on 30 May 1970. Except for abnormal coloration the present specimen exhibits all the characteristics of a spotted gar.

15193. Stobo, Wayne T. (Biol. Dept. Dalhousie Univ., Halifax, Nova Scotia, Canada). 1972. EFFECTS OF FORMALIN ON THE LENGTH AND WEIGHT OF YELLOW PERCH. Trans. Amer. Fish. Soc., 101(2): 362-364.

This paper presents the results of a series of observations on the effects of 10% formalin on the length and weight of yellow perch during an 18.5 month period. The effect of formalin on the length of perch is small. Shrinkage began almost immediately in the smaller length group, and was largely complete within 24 hours. Initially, in the larger perch, an increase in length occurred, probably due to body relaxation. Shrinkage began within one hour, but mainly compensated for the earlier increases, and was essentially complete within 5 days. Decreases in length were relatively greater for the smaller perch (1.35%) than for the larger ones (0.05%). No length corrections are thought necessary for preserved perch. The weights of all perch exhibited four stages during the study: an initial rapid increase; a short period of decreased rate of gain; a protracted period of increase; and finally a period of gradual decrease still observed after 557 days. At the end of the experiment average weights were 103.8 - 109.4% of the original mean weights.

15194. Stobo, Wayne T. (Dept. of Biol., Dalhousie Univ., Halifax, Nova Scotia, Canada). 1972. THE EFFECTS OF DART TAGS ON YELLOW PERCH. Trans. Amer. Fish. Soc., 101(2): 365-366.

The retention and possible effects of T-bar spaghetti tags on yellow perch in the field is discussed. In the 3-1/2 month period following field tagging, a total of 26 specimens (length range 9.1-20.5 cm; average 13.1 cm) were recaptured: twenty specimens were taken once, five were recaptured twice, and one taken three times. All fish were recaptured at the point of release. During this period, no evidence of tag loss was found, that is, no recaptured fish exhibited a clipped anal fin and/or a tagging scar but no tag. However, the tags did cause open wounds at the point of attachment. No infection was visually apparent. The tagging method is satisfactory for yellow perch; tag retention is good; and mortality is insignificant.

15195. Goodyear, C. Phillip (Savannah River Ecol. Lab., Drawer E, Aiken, South Carolina 29801). 1972. A SIMPLE TECHNIQUE FOR DETECTING EFFECTS OF TOXICANTS OR OTHER STRESSES ON A PREDATOR-PREY INTERACTION. Trans. Amer. Fish. Soc., 101(2): 367-370.

The concept behind the technique is simple. If a toxicant is introduced into the environment which causes the mosquitofish to behave abnormally, then predation will increase and the number of surviving mosquitofish will decrease. Two controls are needed, i.e., one with the toxicant present but no exposure to the predator; the other with exposure to the predator but no toxicant. By comparing the survival of fish in the test chamber with survival in the two controls, it is possible to determine if the toxicant alters the predator-prey relationship. Experience with the technique indicates that it could be particularly useful for several reasons. Mosquitofish and largemouth bass are widely available and their behavior is extremely predictable within the chambers. Simple alterations of the basic design of this test system would allow it to be used for a variety of experiments.

15196. Menzel, Bruce W., and David M. Green, Jr. (Dept. of Zool. & Entomol., Science Hall, Iowa State Univ., Ames, Iowa 50010). 1972. A COLOR MUTANT OF THE CHAIN PICKEREL, Esox niger LeSueur. Trans. Amer. Fish. Soc., 101(2): 370-372.

In the course of a study of the population dynamics of the fishes of Dryden Lake, near Ithaca, New York, a color mutation was found among the chain pickerel population. The mutants entirely lack the dark chain-like reticulations characteristic of that species. In life the dorsal surface of these individuals is deep metallic blue-purple, mottled with darker spots and becoming blue-green laterally. The ventral surface is immaculate. There is a deep purple subocular bar. The cheek and opercle are metallic blue-purple, becoming greener below. A dusky blue-purple color occurs uniformly over the dorsal surface of the head and snout. The lateral line sensory pits and other accessory pits on the sides are set off as small metallic gold dashes. The fin rays are dusky with a slight pink tinge, and the interradial membranes are clear.

15197. McCaskill, Matt L., Jamie E. Thomerson, and Paul R. Mills (Biol. Sci., Southern Ill. Univ., Edwardsville, Illinois 62025). 1972. FOOD OF THE NORTHERN STUDFISH, Fundulus catenatus, IN THE MISSOURI OZARKS. Trans. Amer. Fish. Soc., 101(2): 375-377.

The northern studfish, Fundulus catenatus, is a large killifish found in clear streams of the Interior Highlands. It is common in many Ozark streams and may be an important forage species. Analysis of stomach contents suggests that northern studfish primarily utilize the most available immature aquatic insects.

15198. Pasch, R. W., and J. H. Lyford, Jr. (Dept. of Gen. Sci., Oregon State Univ., Corvallis, Oregon 97331). 1972. THE FOOD HABITS OF TWO SPECIES OF Cottus OCCUPYING THE SAME HABITAT. Trans. Amer. Fish. Soc., 101(2): 377-381.

Analysis of stomach contents suggests that no serious competition for food between Cottus perplexus and C. rhotheus occurred in Rock Creek during the study

period. The food items which were common to both species of fish were also those which were relatively abundant in the habitat. C. perplexus, because of its smaller size, relied more heavily on the smaller food items, such as midge larvae and baetids, while C. rhotheus was able to more fully utilize the full range of bottom fauna in the stream.

15199. Park, Donn L., and Winston E. Farr (NMFS, Biol. Lab., 2725 Montlake Blvd. East, Seattle, Washington 98102). 1972. COLLECTION OF JUVENILE SALMON AND STEELHEAD TROUT PASSING THROUGH ORIFICES IN GATEWELLS OF TURBINE INTAKES AT ICE HARBOR DAM. Trans. Amer. Fish. Soc., 101(2): 381-384.

As a total of 172,785 juvenile salmon and steelhead trout were trapped over the 2-month period by the collection system at Ice Harbor Dam, the ability of the system to capture and hold a large number of fish has been demonstrated. The system was successful in capturing sufficient numbers of salmon and steelhead smolts in good condition for the transportation studies; we believe, therefore, that it could be applicable for the capture of juvenile fish at other dams where orifices are constructed. (Authors summ.)

15200. Keenleyside, Miles H. A. (Dept. of Zool., Univ. of W. Ontario, London, Ontario, Canada). 1972. INTRASPECIFIC INTRUSIONS INTO NESTS OF SPAWNING LONGEAR SUNFISH (PISCES: CENTRARCHIDAE). Copeia No. 2, 272-278.

Northern longear sunfish (Lepomis megalotis peltastes Cope) breed in colonies of closely-spaced nests, each defended by a mature male. Conspecifics often intrude briefly into a nest with a spawning pair and are driven away by the resident male. This disruptive intrusion behavior is performed by neighboring territorial males, smaller non-territorial males, and females. Intrusion rate and distance of intruding territorial males are independent of the presence of eggs in the intruder's nests. The main function of nest intrusion by females is eating eggs; by males it is apparently the fertilization of eggs in another male's nest. The possible selective value of male nest intrusion behavior is discussed. (Auth.)

15201. Kroger, R. L., and J. F. Guthrie (NMFS, Beaufort, North Carolina 28516). 1972. INCIDENCE OF THE PARASITIC ISOPOD, Olencira praegustator, IN JUVENILE ATLANTIC MENHADEN. Copeia No. 2, pp. 370-374.

Infestation frequency of the parasitic isopod, Olencira praegustator (Latrobe), in juvenile Atlantic menhaden, Brevoortia tyrannus (Latrobe) was estimated in collections from 19 estuaries along the Atlantic Coast while conducting tagging studies in September 1970. Extensiveness of parasite damage, developmental stage of the parasites and number of parasites lost from the fish were also investigated. Infestation frequencies ranged from 0% to 46% in juveniles from the 19 estuaries. Isopods were present in every sample of juvenile menhaden from the 14 estuaries south of Long Island, New York except for the collections from Chowan River, North Carolina. Five samples collected on or north of Long Island, however, did not contain any isopods. The presence of the isopod and the resulting damage may change the fish's behavior, affect its feeding and growth, or even cause mortality. Parasitized adult menhaden occurred much more frequently in schools of injured fish caught in the estuaries than in schools caught commercially by purse seiners, suggesting that parasitized menhaden may come into estuaries to recuperate. Present observations and knowledge do not permit an accurate assessment of the impact of the isopod on menhaden growth or survival.

15202. Hawkins, Rosemary I., and Lionel E. Mawdesley-Thomas (Huntingdon Research Centre, Huntingdon, England). 1972. FISH HAEMATOLOGY - A BIBLIOGRAPHY. J. Fish Biol., 4(2): 193-232.

Over 900 references have been documented concerning Fish Haematology. This bibliography, it is hoped, will be of assistance to research workers particularly in their preliminary library search. (Authors)

15203. Payne, R. H., A. R. Child, and A. Forrest (Ministry of Agric., Fish., and Food, Salmon and Freshwater Fish. Lab., Weymouth, England). 1972. THE EXISTENCE OF NATURAL HYBRIDS BETWEEN THE EUROPEAN TROUT AND THE ATLANTIC SALMON. J. Fish Biol., 4(2): 233-236.

Natural hybrids between Atlantic salmon (Salmo salar L.) and European trout (S. trutta L.) have been detected in a sample of 4431 fish which appeared to be Atlantic salmon. The methods of analysis for serum protein, serum esterase and serum lactic dehydrogenase are given. The possible occurrence of hybrids having the appearance of European trout and the effect of introgression on salmon stocks are discussed. (Authors)

15204. Harvey, H. H., and C. R. Bothern (Dept. of Zool., Univ. of Toronto, Toronto, Canada). 1972. COMPENSATORY SWIMMING IN THE KOKANEE AND SOCKEYE SALMON Oncorhynchus nerka (Walbaum). J. Fish Biol., 4(2): 237-247.

When negatively buoyant, such as by increased pressure or loss of swimbladder gas, kokanee and sockeye salmon (Oncorhynchus nerka) attempt to swim upward by increased use of the pectoral fins. This response is termed compensatory swimming. Prior to initial filling of the swimbladder, sockeye fry showed no behavioural response to pressures above atmospheric. Following air-gulping at the surface and bladder inflation, kokanee and sockeye fry responded to increased pressure by assuming a more vertical position and by beating the pectoral fins more rapidly. In young sockeye this response occurred over the pressure range of atmospheric to 20 lb/in^2, and the effect of this behaviour would be to distribute these fish in the upper 14 m of the lacustrine environment. Fingerling kokanee showed a more gradual increase in compensatory swimming over the range of pressure equivalent to depths of 0-50 m. The behaviour of yearling kokanee would tend to concentrate these fish in the upper 30 m. Sockeye older than 1 year responded to negative buoyancy with increased horizontal swimming whilst planing upward on the pectoral fins. Depth distribution postulated on the basis of pressure-induced compensatory swimming is consistent with the known vertical distribution of kokanee and sockeye salmon. (Authors)

15205. Weiss, D. M. (Salmon and Freshwater Fish. Lab., Ministry of Agric., Fish. and Food, London, England). 1972. A SIMPLE ELECTRONIC SMOLT COUNTER. J. Fish Biol., 4(2): 257-260.

The development of methods for the automatic counting of migratory fish has become a matter of some importance in the United Kingdom and elsewhere, owing to the increasing concern over the lack of accurate information about fish stocks. An instrument capable of counting fish accurately and reliably in a variety of conditions remains a goal towards which progress is being made only slowly, despite strenuous efforts by a number of organizations. The fish counters available at present are expensive to buy and sufficiently complex to be difficult to build by the majority of workers in fisheries management, but there are, however, circumstances where fish may be counted by relatively simple means and an example of this is given below. It was found that salmon smolts swimming down a channel or tube could be reliably detected using a simple electronic circuit which was sensitive both to changes in resistance across 2 electrodes set in the water flow, and to the rate of change of resistance. These changes were amplified sufficiently to produce deflections on a recording meter so that subsequent examination of the chart gave both a count of the smolts and also the time of passage. Details of the circuit, which can be built at low cost and with only elementary equipment, are discussed briefly and some of the results are given. (Auth.)

15206. Barker, C. J. (Ministry of Agric., Fish. and Food, Fisheries Radiobiological Lab., Lowestoft, Suffolk, England). 1972. A METHOD FOR THE DISPLAY OF CHROMOSOMES OF PLAICE, Pleuronectes platessa, AND OTHER MARINE FISHES. Copeia, No. 2, 365-368.

15207. Yasutake, William T., and Donald F. Amend (Bur. of Sport Fish. & Wildl., Western Fish Disease Lab., Seattle, Washington 98115). 1972. SOME ASPECTS OF PATHOGENESIS OF INFECTIOUS HEMATOPOIETIC NECROSIS (IHN). J. Fish Biol., 4(2): 261-264.

The histopathogenesis of infectious haematopoietic necrosis (IHN) virus infection was studied by exposing juvenile sockeye salmon (Oncorhynchus nerka) to the IHN virus. Fish samples were taken every 24 h for histological examination and for determination of virus concentration. A close correlation was found between histopathological changes and virus concentration. The most significant changes occurred 4 days after exposure. The haematopoeitic tissue of the kidney was the most extensively involved but minor degenerative changes were seen in the liver, pancreas, and in the granular cells of the digestive tract. On the 4th day, maximum tissue concentration of virus was reached and the mortality increased. By the 5th days, 90% of the samples showed extensive pathological changes in the kidney, together with variable changes in spleen, liver, pancreas, and gut. Similarities in the histopathogenesis of IHN, Oregon sockeye disease (OSD), Sacramento River chinook disease (SRCD) and viral haemorrhagic septicaemia (VHS), are discussed. (Authors)

15208. Bibby, M. C. (Dept. of Zool., Univ. College of Wales, Aberystwyth, Wales). 1972. POPULATION BIOLOGY OF THE HELMINTH PARASITES OF Phoxinus phoxinus (L.), THE MINNOW, IN A CARDIGANSHIRE LAKE. J. Fish Biol., 4(2): 289-300.

Specimens of Phoxinus phoxinus (L.) were collected over a period of a year from September 1967 to September 1968 from Frongoch Lake, Cardiganshire, Wales. Of a total of 650 fish examined for helminth parasites, 32% were definitive hosts for Macrolecithus papilliger, and 16.5% for Neoechinorhynchus rutili (Müller), both parasites of the alimentary canal. All the fish examined were second intermediate host for Diplostomum phoxini (Faust) in the brain and 1.67% for Ligula intestinalis (L.) in the coelom. An increase in incidence of infestation with M. papilliger in spring and autumn and with N. rutili in summer were evident. The sex of the fish had no apparent effect on worm burden whereas size was more significant. There was a decrease in incidence of infestation with M. papilliger and and increase with N. rutili together with an increase in intensity of infestation with D. phoxini as the fish became larger. The latter species accumulated in the brain as the host increased in age. (Auth.)

15209. Gerking, Shelby D. (Dept. of Zool., Arizona State Univ., Tempe, Arizona). 1972. REVISED FOOD CONSUMPTION ESTIMATE OF A BLUEGILL SUNFISH POPULATION IN WYLAND LAKE, INDIANA, U.S.A. J. Fish Biol., 4(2): 301-308.

The estimate of food consumption by the bluegill sunfish (Lepomis macrochirus) population of Wyland Lake, Indiana, was examined with reference to recent research on the length of the growing season and the effect of body weight, ration and activity on growth efficiency. Growth efficiency was measured in the laboratory in terms of protein, comparing nitrogen assimilated with nitrogen accumulated over a period of about 30 days. The revised consumption of protein was 134.9 kg (or 1407 kg live weight of aquatic organisms, 444 kg/ha) during a growing season of 111 days compared with the original estimate of 127.3 kg calculated for an assumed growing season of 150 days, a difference of only 6%. The correspondence between the two estimates was coincidental. The original estimate was made at a time when the growing season had not been measured and the effect of ration and body size on growth efficiency was not precisely known. Corrections for these factors plus that for activity compensated for one another, closely approaching, by chance, the original value. (Auth.)

15210. Negonovskaya, I. T. (State Res. Inst. for Lake and River Fisheries (GosNIORKh), Leningrad, USSR). 1971. CONDITIONS OF NATURAL REPRODUCTION OF THE PIKE-PERCH [Lucioperca lucioperca (L.)] IN LAKE PSKOV-CHUD. J. Ichthyology, published by Amer. Fish. Soc., 11(4): 630-635.

15211. Palmer, T. N., and Brenda E. Ryman (Dept. of Biochem., Royal Free Hospital School of Medicine, 8 Hunter St., London, W.C.1, England). 1972. STUDIES ON ORAL GLUCOSE INTOLERANCE IN FISH. J. Fish Biol., 4(2): 311-319.

The oral glucose tolerance test, a diagnostic procedure used in the detection of human diabetes, was used to study carbohydrate metabolism in rainbow trout, Salmo gairdneri (Richardson). Fish exhibited pronounced and persistent hyperglycaemia on oral glucose administration. Hyperglycaemia was accompanied by decrease in blood amino acids, serum free fatty acids and cholesterol and marked increase in hepatic storage of glycogen. The incidence of oral glucose intolerance results, at least in part from insufficient circulating insulin. Exogenous insulin exerts a hypoglycaemic action and effectively abolishes the hyperclycaemia resulting from glucose administration. Tolbutamide, the sulphonylurea hypoglycaemic drug, is without effect. Possibly as an indirect result of hyperadrenocorticism, oral glucose tolerance is markedly improved in the pre-spawning female. Long-term feeding of high carbohydrate diet to goldfish Carassius auratus (L.) resulted in gross hepatomegaly due to excessive hepatic glycogen accumulation and, possibly, fatty change of the liver. Protein metabolism was impaired as evidenced by protein depletion. Such degenerative changes in liver metabolism are probably a direct result of oral glucose intolerance and reflect a metabolism adapted to diets normally low in available carbohydrate. (Authors)

15212. Morris, R. L., and L. G. Johnson (Hygienic Lab., Iowa Univ., Iowa City, Iowa). 1971. DIELDRIN LEVELS IN FISH FROM IOWA STREAMS. Pesticides Monitoring Journal, 5(1): 12-16; Selected Water Resources Abstracts, 5(9): 37, 1972.

Several species of fish from Iowa streams were analyzed to determine the levels of dieldrin and other durable pesticides in the edible portion of their flesh. Composite samples were extracted into 35 percent water/acetonitrile and analyzed by gas chromatography. Catfish had the highest dieldrin levels (up to 1600 ppb). Elevated dieldrin levels were also found in carp and buffalo but not in bass, crappie, bluegill, walleye, and northern pike. Residues of other chlorinated hydrocarbon insecticides were detected in the samples but at levels significantly below the dieldrin concentrations. Traces of DDT and its metabolites, heptachlor epoxide, aldrin, and gamma and alpha chlordane were detected in many of the samples. The rivers studied drain row cropland that is sprayed with aldrin to control agricultural pests. Fish taken from rivers not draining row cropland do not exhibit this phenomenon. Pesticides apparently are absorbed on soil particles and move into streams during rain or snow-melt runoff on erosion silt. Improved soil conservation practices resulting in reduced siltation must be instigated on a broad scale to keep agricultural pesticides on the fields and out of streams.

15213. Inglis, A., C. Henderson, and W. L. Johnson (Bur. of Sport Fish. and Wildl., Washington, D. C.). 1971. EXPANDED PROGRAM FOR PESTICIDE MONITORING OF FISH. Pesticides Monitoring Journal, 5(1): 47-49; Selected Water Resources Abstracts, 5(9): 37, 1972.

Beginning in the fall of 1970, 50 new stations were added to the original 50 stations sampled annually by the Bureau of Sport Fisheries and Wildlife for monitoring pesticide residues in fish. The original 50 stations, sampled since the spring 1967, will be retained in the expanded program. Three composite samples, each containing 3-5 adult fish of a single species, will be collected. All composite samples will be replicated for a total of 600 samples analyzed annually. Residue analyses will be performed for the identification and quantitation of DDT, DDE, TDE, dieldrin, aldrin, endrin, BHC, heptachlor, heptachlor epoxide, chlordane, toxaphene, mercury, arsenic, and lead. Samples will be screened for the presence of interfering polychlorinated biphenyl compounds (PCB's). Fish will be collected and handled in such a manner as to prevent contamination of the sample with extraneous chemicals.

15214. Water Resources Research Inst., Oregon State University (Corvallis, Washington). 1972. TEMPERATURE REQUIREMENTS OF SALMONIDS IN RELATION TO THEIR FEEDING, BIOENERGETICS, GROWTH, AND BEHAVIOR. Summary Progress Report, January 1, 1972, 23 p.; Selected Water Resources Abstracts, 5(9): p. 56.

Laboratory studies are designed to define, in terms of food consumption, bioenergetics, and growth of fish, the temperature conditions to which fish can adapt physiologically. The model stream studies simulate conditions of elevated temperature to which fish and other organisms may be exposed in natural streams. The stream experiments are designed to evaluate--the effects of a modified temperature regime on important ecological relationships in an aquatic community. Evaluations were made on the basis of differences in the behavior, food relations, growth, and production of salmon, and differences in the abundance of plants and invertebrates in a heated and a control stream. Phase I of the study, terminated in July, 1971, examined the effects of elevated temperature on juvenile coho salmon. During Phase II model stream and laboratory studies will evaluate the response of juvenile chinook salmon, Oncorhynchus tshawytsch., to elevated temperatures. Laboratory studies with juvenile steelhead trout, Salmo gairdneri, will permit comparison of the temperature response of this species with that of the Pacific salmon.

15215. Monakov, A. V. (Lab. of Zool., Inst. of Biol. of Inland Waters, Academy of Sciences, USSR, Borok, Nekouz, Jaroslavl, USSR). 1972. REVIEW OF STUDIES ON FEEDING OF AQUATIC INVERTEBRATES CONDUCTED AT THE INSTITUTE OF BIOLOGY OF INLAND WATERS, ACADEMY OF SCIENCE, USSR. J. Fish. Res. Bd. Canada, 29(4): 363-383.

The main results obtained at the Borok Institute during the last decade are reviewed. Food and methods of feeding by various aquatic invertebrates (Rotatoria, Oligochaeta, Mollusca, Cladocera, Copepoda, Chironomidae larvae), daily food consumption, and assimilation of food have been investigated. Most invertebrates are omnivores although some species live on only one type of food. Daily food consumption changes with food concentration, temperature, and size of consumer. At 15-22 C and a concentration of food close to optimum, mean daily rations of most invertebrates studied usually range from 25 to 100% of body weight. Only in pulmonary Gastropoda and silt-eating Tubificidae does it greatly exceed body weight. In rare cases, at very high concentration of food unusual in nature, the so-called "extra feeding" may take place under experimental conditions. For most invertebrates feeding on natural food at optimum concentrations, index of assimilation varies widely, but rarely exceeds 50%. The assimilability of plant food was 45-55% in the majority of investigated species and appears to be considerably higher when animal food is used. (Auth.)

15216. Trust, T. J., and Vida G. Money (Dept. of Bacteriology and Biochem., Univ. of Victoria, Victoria, British Columbia, Canada). 1972. BACTERIAL POPULATION OF DIETS FOR AQUARIUM FISHES. J. Fish. Res. Bd. Canada, 29(4): 429-433.

Twenty-five commercial diets formulated and offered for feeding to aquarium fish were examined to determine their microbial burden. The total count of aerobic mesophilic bacteria in 24 of the feeds ranged from 9×10^2 to 1.3×10^6 per gram of diet. Twenty of the diets contained from 7×10^2 to 2.4×10^5 bacteria per gram able to grow anaerobically. One of the feeds was sterile. Species from the genus Bacillus were most numerous, but species of Clostridium (including C. perfringens), enterococci, and members of the Enterobacteriaceae were also present in significant numbers. The fish diets supported the growth of a wide variety of bacteria known to be pathogenic to fish and to man. (Authors)

15217. Sundararaj, Bangalore I., Shashi V. Goswami, and E. M. Donaldson (Dept. of Zool., Univ. of Delhi, Delhi 7, India). 1972. EFFECT OF SALMON GONADOTROPIN ON IN VITRO MATURATION OF OOCYTES OF A CATFISH, Heteropneustes fossilis. J. Fish. Res. Bd. Canada, 29(4): 435-437.

Salmon gonadotropin failed to induce in vitro ovulation of catfish oocytes at

concentrations of 1-40 μg/ml. This observation is consistent with the view that gonadotropin may not act directly on the ovary of catfish in inducing ovulation. (Authors)

15218. Jessop, B. M. (Dept. of Biol., Univ. of Waterloo, Waterloo, Ontario, Canada). 1972. AGING ROUND WHITEFISH (Prosopium cylindraceum) OF THE LEAF RIVER, UNGAVA, QUEBEC, BY OTOLITHS. J. Fish. Res. Bd. Canada, 29(4): 452-454.

Ages assigned to 503 round whitefish (Prosopium cylindraceum (Pallas)) from the Leaf River on the basis of otoliths differed notably from those assigned on the basis of scales only for fish above age 8. The hyaline zones in otoliths corresponded to the scale annuli, and the growth increments in otoliths at various dates as percentages of the totals during the collection period were similar to those for scales. Otolith radius increased linearly with fork length, as did otolith weight with fish age. (Auth.)

15219. Carlson, Clarence A., and M. H. Shealy, Jr. (N. Y. Coop. Fish. Unit, Dept. of Nat. Res., Cornell Univ., Ithaca, New York 14850). 1972. MARKING LARVAL LARGEMOUTH BASS WITH RADIOSTRONTIUM. J. Fish. Res. Bd. Canada, 29(4): 455-458.

Largemouth bass (Micropterus salmoides) were marked by exposing newly-hatched prolarvae to 6.4, 11.3, and 16.8 μCi ^{85}Sr/liter pond water for 7 days. Embryos were collected by pipette from nests in ponds and incubated to hatching in disposable aquaria in the laboratory. Radiostrontium accumulation from water continued throughout the first week of postembryonic life but was most rapid after the fourth day of exposure. In another study the techniques were found useful for quantifying predation on larval bass by aquatic invertebrates. (Authors)

15220. Carline, R. F., and O. M. Brynildson (Wis. Dept. of Nat. Res., Hartman Creek, Waupaca, Wisconsin 54981). 1972. EFFECTS OF THE FLOY ANCHOR TAG ON THE GROWTH AND SURVIVAL OF BROOK TROUT (Salvelinus fontinalis). J. Fish. Res. Bd. Canada, 29(4): 458-460.

We conducted two field trials to determine the effects of the gun-injected, Floy anchor tag (FD-67) on growth and survival of 10-month-old domesticated brook trout (Salvelinus fontinalis) in a 0.7 ha pond. Trials ran from October to the following June. In 1968 we stocked 106 tagged trout and 1005 controls, and in 1969, 300 tagged trout and 500 controls. We removed different fins from each group to determine tag loss. In both trials we sampled the trout twice through the ice and twice during open water. The tags retarded growth of the trout from October to January; differences in growth rates between tagged and controls were 18 and 28% for the 1968 and 1969 trials, respectively. After January both groups grew at similar rates. The tags did not affect survival, and tag losses were 5.7 and 2.0% for the two trials. (Authors)

15221. Dadikyan, M. G. (Sevan Hydrobiological Sta., Armenian Academy of Sciences, Sevan, USSR). 1971. THE CAUSES OF DIVERGENCE OF THE SEVAN TROUT [Salmo ischchan (Kessler)]. J. Ichthyology published by Amer. Fish. Soc., 11(4): 455-463.

The article is devoted to the clarification of the causes and time of origin of races of the Sevan trout, the sequence of their appearance and their genealogy. The Sevan trout originated from the brook trout, which still inhabits some of the streams flowing into Lake Sevan, into which it penetrated from the Araks River through the Paleo-Makenis, the Paleo-Argichi and the Paleo-Vardenis. The species and its races originated in the period of the Wurmian glaciation and in postglacial times. (Auth.)

15222. Kolyushev, A. I. (Pskov Div., State Res. Inst. for Lake and River Fish., (GosNIORKh), USSR). 1971. SOME OSTEOLOGICAL CHARACTERS OF CHARS (GENUS Salvelinus) IN CONNECTION WITH THE PROBLEM OF THEIR SYSTEMATIC POSITION. J. Ichthyology published by Amer. Fish. Soc., 11(4): 464-473.

Osteological characters are important in the solution of problems of the systematics of fishes, especially chars of the genus Salvelinus. A comparative study of the size ratios and shape of the skull bones of the chars of lakes in the Kola Peninsula, Lake Ladoga and Lake Onega shows that they are genetically similar and of common origin, and on this basis they may be classified as belonging to a single polymorphic species Salvelinus alpinus (L.).

15223. Shaposhnikova, G. Kh. (Zool. Inst., USSR Acad. of Sciences, Leningrad, USSR). 1971. A COMPARATIVE MORPHOLOGICAL DESCRIPTION OF LAKE SEVAN WHITEFISHES OF THE GENUS Coregonus. J. Ichthyology published by Amer. Fish. Soc., 11(4): 474-484.

Consideration is given to changes in the morphological characters of the Lake Chud whitefish [Coregonus lavaretus maraenoides (Poljakow)] and the Ladoga ludoga [C. lavaretus ludoga (Poljakow)] acclimatized in Lake Sevan more than 40 years ago. Osteological and biometric studies have shown the Sevan whitefishes to be distinctive. There is at the present time in Lake Sevan a single whitefish stock, among which the ancestral forms are present only in small quantity. The process of the merging of the two forms is still not complete, and it is therefore premature to speak of their taxonomic position.

15224. Ivankov, V. N., and V. L. Andreyev (Inst. of Marine Biol., Far Eastern Dept., USSR Acad. of Sci. and Far Eastern State Univ., Vladivostok, USSR). 1971. THE SOUTH KURIL' CHUM [Oncorhynchus keta (Walb.)] - ECOLOGY, POPULATION STRUCTURE AND THE MODELLING OF THE POPULATION. J. Ichthyology published by Amer. Fish. Soc., 11(4): 511-524.

Data are presented on the structure of spawning stocks of the South Kuril' chum, on the conditions of its reproduction and the nature of reproduction; a cybernetic model for finding the optimum control of the abundance of the population is given. It has been established that the chum of the South Kuril' Islands is characterized by an extremely high growth rate and low fecundity (2557 eggs). The chum spawns mainly in November at 5-6°C; the mortality of eggs and embryos in the redds during the incubation period averages 50%. Computer modelling of the chum population has made it possible to predict that slightly less than 60% of the spawners must be caught if the highest abundance is to be attained.

15225. Rudenko, G. P. (State Res. Inst. for Lake and River Fish. (GosNIORKh), Leningrad, USSR). 1971. BIOMASS AND ABUNDANCE IN A ROACH-PERCH LAKE. J. Ichthyology published by Amer. Fish. Soc., 11(4): 524-535.

Data are given concerning the biomass, production, abundance, and the size-age and sex structure of the populations obtained as a result of a record of the fishes killed in a lake treated with a toxicant. The annual increment of biomass was determined from the loss of fishes from total and natural mortality.

15226. Shchepkin, V. Ya. (Inst. of the Biol. of the Southern Seas (InBYUM), Ukrainian Acad. of Sci., Sevastopol, USSR). 1971. THE DYNAMICS OF LIPID COMPOSITION IN THE BLACK SEA HORSEMACKEREL [Trachurus mediterraneus ponticus (Aleev)] IN RELATION TO MATURATION OF THE GONADS AND SPAWNING. J. Ichthyology published by Amer. Fish. Soc., 11(4): 587-591.

The generative synthesis and spawning of the Black Sea horsemackerel are accompanied by intensive mobilization of lipid reserves both in the liver and in the muscles. The greatest activation of lipid metabolism is noted in the period of trophoplasmic growth when stored lipids are involved in synthesis of the trophic and "building" material of the gonads. Triglycerides are the fraction in horsemackerel lipids which has the most considerable concentration and is the most labile. Because triglycerides are an oxidation substrate with an extremely high energy capacity they are actively utilized in the energy processes of metabolism. Generative synthesis in the horsemackerel is accompanied by alteration of the quantitative characteristics of all lipid fractions.

15227. Pavlov, A. V. (Central Sturgeon Fish. Res. Inst. (TsNIORKh), Astrakhan, USSR). 1971. THE VOLGA WATER DIVERSION AND STURGEON. J. Ichthyology, published by Amer. Fish. Soc., 11(4): 536-542.

It is shown that construction of the Volga water diversion will do some damage to sturgeon. The dam will hold back a considerable part of the sturgeon spawners in the afterbay. It is proposed to increase the fishway part of the dam, and also to construct one or two fish hatcheries and to release young in the eastern half of the Volga delta to compensate the harm done to sturgeon.

15228. Gritsenko, O. F. (All-Union Res. Inst. for Sea Fish. and Oceanogr. (VNIRO), Moscow, USSR). 1971. GROWTH, MATURATION AND FECUNDITY OF THE CHAR [Salvelinus alpinus (L.)] OF RIVERS ON SAKHALIN ISLAND. J. Ichthyology published by Amer. Fish. Soc., 11(4): 555-568.

Consideration is given to features of the growth, maturation and fecundity of the char in relation to the availability of food, which consists basically of salmon eggs and larvae. Growth rate, the rate of maturation and the fecundity of the char are higher in those bodies of water where it consumes more salmon eggs and young salmon. An analysis is made of the reproductive capacity of the anadromous, river and brook forms of the char.

15229. Grachev, L. Ye. 1971. VARIATION IN THE NUMBER OF OOCYTES IN CHUM SALMON [Oncorhynchus keta (Walb.)] DURING THE MARINE PERIOD. J. Ichthyology published by Amer. Fish. Soc., 11(4): 576-586.

The number of oocytes in young chum begins to increase after migration to the sea as the weight of the body and the gonads increases. The largest quantity of oocytes was found in underyearlings with ovaries weighing approximately 100 mg. When the weight of the gonads is further increased the quantity of oocytes is reduced in all age groups, despite increase of body weight. The number of oocytes varies insignificantly in fish not maturing in a given year; in fish which are maturing the amount of degeneration of the oocytes is dependent on the rate of maturation and on growth rate. A connection is traced between the quantity of oocytes and the condition of the fish.

15230. Moroz, I. Ye. (Volgograd Dept., State Res. Inst. for Lake and River Fisheries, USSR). 1971. DYNAMICS OF METABOLISM IN THE CARP [Cyprinus carpio (L.)] DURING OVERWINTERING. J. Ichthyology published by Amer. Fish. Soc., 11(4): 592-596.

An account is given of the dynamics of the content and expenditure of protein, nonprotein nitrogen, lipid, carbohydrates (glycogen, glucose and fructose), phosphorus of ATP and dry matter in the muscles of young carp during overwintering. The investigations carried out have shown that the metabolic rate is largely dependent on environmental conditions.

15231. Branover, G. G., A. S. Vasil'yev, S. I. Gleyzer, and A. B. Tsinober (Fish. and Fish Industry Technical Inst. and Atlantic Res. Inst. for Sea Fish. and Oceanogr. (AtlantNIRO), Kaliningrad, USSR). 1971. A STUDY OF THE BEHAVIOR OF THE EEL IN NATURAL AND ARTIFICIAL AND MAGNETIC FIELDS AND AN ANALYSIS OF ITS RECEPTION MECHANISM. J. Ichthyology published by Amer. Fish. Soc., 11(4): 608-614.

A large amount of experimental material has been obtained which confirms the ability of young eels to perceive a magnetic field. It is shown that the magnetic field is responsible for the existence of a preferred direction of movement. A theory of the magnetohydrodynamic mechanism of the reception of the magnetic field has been developed and conclusions stemming from this theory have been verified by experiments in the field of an electromagnet.

15232. Volkova, L. A. (Baikalian Biol. Sta. of the Biol. and Geographical Res. Inst. of Irkutsk Univ., B. Koty, Irkutsk Province, USSR). 1971. DAILY CHANGES IN THE SCHOOLING BEHAVIOR OF SOME LAKE BAIKAL FISH. J. Ichthyology published by Amer. Fish. Soc., 11(4): 596-607.

Experimental data are given concerning daily variations in the schooling

behavior of the Baikal cisco, the yellowfin Baikal sculpin, the Baikal grayling, the roach, the Siberian dace, the common minnow and the perch in different stages of ontogeny and under conditions of different levels of feeding. The threshold values of illumination at which schools of these fish form and disperse are established.

15233. Rizvanov, R. A. (Lake Mgmt. Lab., State Res. Inst. for Lake and River Fisheries (GosNIORKh), Leningrad, USSR). 1971. THE AVAILABILITY OF FOOD AND SPAWNING GROUNDS FOR THE LAKE LADOGA PIKE-PERCH [Lucioperca lucioperca (L.)]. J. Ichthyology published by Amer. Fish. Soc., 11(4): 624-630.

The food of the adult pike-perch consists of valuable species (smelt and cisco) and also of species of little value, including roach, perch and ruffe. Young pike-perch consume Mysidae, zooplankton, smelt, cisco and pike. The pike-perch does not fully utilize the food resources. The pike-perch is adequately supplied with spawning grounds and utilizes only 8.4% of them at its present level of abundance. Inasmuch as the food resources and spawning areas of the lake are underutilized by the pike-perch, the possibility of an increase in its abundance exists.

15234. Konstantinova, N. A., and V. L. Zubenko (Ukrainian Fish. Res. Inst. (UkrNIIRKh), Kiev, USSR). 1971. OOGENESIS AND MATURATION OF THE BLUE BREAM [Abramis ballerus (L.)] IN KIEV RESERVOIR. J. Ichthyology published by Amer. Fish. Soc., 11(4): 636-641.

The process of oogenesis appears as follows in the blue bream of Kiev reservoir in the age categories of the spawning population (3-5 years). End of April-June–post-spawning stage VI and VI-II of maturity, resorption of empty follicles and unspawned oocytes, coefficient of maturity 1.3-1.4%. End of June-August–growth of a new generation of oocytes, vacuolation and initial accumulation of yolk, stage III of maturity, coefficient of maturity 2-3%. September-April–phase of yolk filling of the oocytes, stage IV of maturity. Coefficient of maturing 4-7% in October, 8-12% in April. Mass sexual maturation of blue bream females occurs at an age of 4 years and a body length of 23-26 cm and only a small percentage of the fish mature at an age of 3 years and a body length of at least 21 cm. Therefore, no acceleration of the rate of maturation is observed under the new environmental conditions. Maturity stage II lasts until the middle of the fourth year of life of the fish, as it also did under river conditions although then fish 3+ years old were shorter, 16-20 cm. The improvement of feeding conditions in the reservoir by comparison with the river is responsible for an increase in the reproductive capacity of the blue bream population as a result of an increase in growth rate and an increase in fecundity but not as a result of acceleration of the rate of maturation.

15235. Yakubov, S. M., V. I. Chernyshov, Yu. P. Kozlov, and B. N. Tarusov (Dept. of Biophysics, Moscow State Univ., USSR). 1971. SOME PHYSICO-CHEMICAL PROPERTIES OF THE LIPIDS OF ORGANS OF THE CARP [Cyprinus carpio (L.)] WITH INFLAMMATION OF THE SWIM BLADDER. J. Ichthyology published by Amer. Fish. Soc., 11(4): 642-645.

In investigation of the antioxidizing activity (AOA) of lipids in different stages of inflammation of the swimbladder (ISB) in the carp it was established that the most contrasting changes were characteristic in the first instance for the lipids of the spleen, blood and kidneys. A light stage of ISB is characterized by an increased level of AOA in all tissues. A particularly sharp increase of the AOA level was noted for the lipids of the spleen, blood and kidneys, i.e., for lipids isolated from organs of the hematopoietic system. Then, as the inflammation developed, the AOA level fell. Investigation of the hemolytic activity (HA) of the lipids of the organs stipulated showed that a slight rise of the HA level of blood lipids was noted in the light stage, and that this rise subsequently reached its maximum in the moderate stage. A reduction of HA relative to the level of the moderate stage was noted in the severe stage. At the same time the lipids of the spleen and the liver became most toxic in the severe stage. It was characteristic of the provisionally healthy group that the lipids of the blood, spleen and kidneys, which had an increased AOA, had at the same time reduced hemolytic activity. A sharp increase in the yield of loosely-bound lipids from the spleen was noted in the light

stage of ISB, followed in the moderate and severe stages by gradual reduction, whereas continuous reduction of yield was noted throughout the experiments in the liver and kidneys. The identical nature of the dynamics of variation in the yield of loosely bound lipids and in the AOA level of the lipids apparently indicates the existence of a definite correlation between these characteristics.

15236. Ransom, John D., and Troy C. Dorris (Kansas State Teachers College, Emporia, Kansas). 1972. ANALYSES OF BENTHIC COMMUNITY STRUCTURE IN A RESERVOIR BY USE OF DIVERSITY INDICES. Amer. Midl. Nat., 87(2): 434-447.

Benthic macroinvertebrate and physicochemical collections were made monthly in four bays of Keystone Reservoir, Oklahoma, from early November 1965 through October 1966. Benthic community structures were subjected to species diversity analyses and the results were related to selected physicochemical estimates. A total of 25 benthic macroinvertebrate species were collected. There was a high, inverse correlation between diversity (d) and conductivity, and between d and depth. There was a direct, high correlation between conductivity and depth. There were significant differences in annual diversity (d) between bays which differed in water quality. Diversity indices were an easy and reliable method of determining long-term effects of waters of different qualities on the benthic fauna within reservoirs. The method should be of equal value when used on an entire reservoir, or in making comparisons between reservoirs. (Authors)

15237. Mondl, Mark C., and Francis C. Rabalais (Dept. of Biol., Bowling Green St. Univ., Bowling Green, Ohio). 1972. HELMINTH PARASITES OF Ictalurus melas, Lepomis cyanellus AND Carassius auratus FROM THE OTTAWA NATIONAL WILDLIFE REFUGE, OHIO. Amer. Midl. Nat., 87(2): 543-545.

A helminth survey of three species of fish from the Ottawa National Wildlife Refuge, Ottawa Co., Ohio, yielded 10 species of parasites. New host records are reported for Corallobothrium minutium, larval Eustrongylides sp., the cystacanth of Arhythmorhynchus brevis and the cysticercoid of Dendrouterina sp.

15238. Toetz, Dale W. (Dept. of Zool., Okla. State Univ., Stillwater, Oklahoma). 1972. OBSERVATIONS ON THE NITROGEN-FIXING POTENTIAL OF THE PLANKTON OF TWO FARM PONDS. Amer. Midl. Nat., 87(2): 555-559.

The N_2 fixing potential of the open water of two farm ponds in central Oklahoma was studied, using the ^{15}N technique and the acetylene reduction method. Nitrogenase activity was detected during the winter in a pond where Ceratophyllum and Nelumbo were the dominant macrophytes. This paper describes the methods and certain facets of the environment when observations were made. (Auth.)

15239. Costa, Robert R., and Kenneth W. Cummins (Pymatuning Lab. of Ecol., Univ. of Pittsburgh, Pittsburgh, Pennsylvania). 1972. THE CONTRIBUTION OF Leptodora AND OTHER ZOOPLANKTON TO THE DIET OF VARIOUS FISH. Amer. Midl. Nat., 87(2): 559-564.

The gut contents of various fish were examined to determine what effect fish had upon the removal of Leptodora kindtii (Focke) and other zooplankton species of Sanctuary Lake, Crawford Co., Pa. Fish caught at any time, but particularly those collected during regular zooplankton tows, were examined. They were identified, measured and their gut contents removed and stained in Congo Red. The entire contents were identified, and particular attention was given to the zooplankton component, especially the fluid-feeding predator, Leptodora kindtii (Focke). A total count of each identifiable species was made and its percentage composition determined. The relative quantity of an item present in the gut was then compared to the relative quantity of that same item in the food complex. In this manner an index of selectivity (Ivlev's [1961] index) was determined. (Authors)

15240. McDiffett, Wayne F., Amy E. Carr, and Diane L. Young (Dept. of Biol., Bucknell Univ., Lewisburg, Pennsylvania). 1972. AN ESTIMATE OF PRIMARY PRODUCTIVITY IN A PENNSYLVANIA TROUT STREAM USING A DIURNAL OXYGEN CURVE TECHNIQUE. Amer. Midl. Nat., 87(2): 564-570.

An estimate of gross primary productivity and community respiration in a Pennsylvania trout stream was made using an upstream-downstream diurnal oxygen curve technique. Values of 4.92 and 6.32 g O_2/m^2/day were calculated for gross primary productivity, and community respiration was 2.30 and 2.02 g O_2/m^2/day. These values are compared with community metabolism data from other flowing water systems. (Authors)

15241. Scalet, Charles G. (Dept. of Zool., Univ. of Okla., Norman, Oklahoma). 1972. FOOD HABITS OF THE ORANGEBELLY DARTER, Etheostoma radiosum cyanorum (OSTEICHTHYES: PERCIDAE). Amer. Midl. Nat., 87(2): 515-522.

The orangebelly darter, Etheostoma radiosum cyanorum, changed its food habits as it increased in size. The young fed primarily on copepods and cladocerans. When the darters reached approximately 16 mm in total length their primary source of food consisted of ephemerids and dipteran larvae. Darters from 22 to 30 mm in total length relied mainly on small ephemerids, dipteran larvae, hydropsychids and baetids. The food of the adult darters consisted primarily of the aquatic larvae and naiads of five families of insects: Tendipedidae (= Chironomidae), Baetidae, Hydropsychidae, Ephemeridae and Simuliidae. The food eaten by the various sizes of darters appeared to be dependent upon the preferability, availability and vulnerability of the food organisms present in the stream. (Auth.)

15242. Campbell, R. N. (Nature Conservancy, Edinburgh, Scotland). 1972. A QUESTIONNAIRE FOR ASSESSING THE ANGLING POTENTIAL OF BROWN TROUT WATERS. J. Inst. Fish. Mgmt, No. 3, pp. 5-12.

This paper contains a suggested layout for a questionnaire which can be filled in by trout lake owners or managers who have requested expert advice on improvement measures. The form can also be used for large scale trout angling resource surveys. The questions are designed to put the expert fully in the picture regarding the total situation concerning a fishery and enabling him to make prescriptions possibly without a site visit or further investigation being involved. The questionnaire is based on case histories from Scottish waters which involved the writer, who has employed this system for some years now. The questionnaire can be adapted to relate to other kinds of freshwater fisheries apart from trout in lakes. (Auth.)

15243. Williams, Ernest H., Jr., and Wilmer A. Rogers (Fish. Lab., Agric. Exp. Sta., Auburn Univ., Auburn, Alabama 36830). 1971. TWO NEW SPECIES OF Gyrodactylus (TREMATODA: MONOGENEA) AND A REDESCRIPTION AND NEW HOST RECORD FOR G. prolongis Hargis, 1955. J. Parasit., 57(4): 845-847.

Two new gyrodactylid Monogenea, Gyrodactylus hargisi and G. mobilensis, are described from the sheepshead minnow, Cyprinodon variegatus Lacépède. Gyrodactylus prolongis Hargis, 1955, is redescribed from its original host, the gulf killifish, Fundulus grandis Baird and Girard, and from a new host, the sheepshead minnow, C. variegatus. (Authors)

15244. Waller, William T., and John Cairns, Jr. (Dept. of Biol. and Center for Environ. Studies, Va. Polytech. Inst. and State Univ., Blacksburg, Virginia 24061). 1972. THE USE OF FISH MOVEMENT PATTERNS TO MONITOR ZINC IN WATER. Water Research, Vol. 6, pp. 257-269.

The feasibility of using fish movement patterns measured by light beam interruption as a technique for continuous monitoring of the response of fish to zinc was investigated. The apparatus does not in any way interfere with fish movement within the test chamber and allows for the maintenance of fish for long time periods. Under the conditions described the system detects premortal aberrations in fish movement caused by zinc. The detection of stress occurs in sufficient time to permit survival of the test fish if stress conditions are reversed at the time of detection. The lowest concentration of zinc detected by the system during a 96-h exposure was between 3.64 and 2.94 mg l^{-1} Zn^{2+}. The system's range of effective measurement as related to turbidity is discussed. This methodology should detect other toxicity equally well. (Authors)

15245. Boyd, Claude E., and C. Phillip Goodyear (Savannah River Ecol. Lab., Aiken, South Carolina). 1971. NUTRITIVE QUALITY OF FOOD IN ECOLOGICAL SYSTEMS. Arch. Hydrobiol., 69(2): 256-270.

The expression of net primary production in terms of dry matter, organic matter, carbon, or energy converts all units of plant production to an equivalent basis. However, net production differs in chemical composition and nutritive value depending upon species, plant age, and habitat. The nutritive quality of net primary production is very important in determining the efficiency of food utilization by herbivores. Nutrient content is equally important in determining the rate of decomposition of organic residues. Carnivores consume food of high nutrient content, especially with respect to protein, and adequate nutrition for these animals is likely determined by the amount of food consumption rather than by nutritive quality. Omnivores and detritivores fall somewhere between carnivores and herbivores with respect to the importance of food quality in regulating their growth and numbers in natural systems. The use of energy flow or transfer in ecosystem analysis is a gross oversimplification of the relationships between organisms and their food. Energy utilization by consumers is regulated by nutritive quality of the food and all other factors regulating population sizes. (Authors)

15246. Goryczko, Krzysztof (Inst. Rybactwa Śródlądowego, Terenowa Pracownia Rzeczna, Gdansk-Oliwa, Poland). 1972. A CHANGE OF THE SPAWNING SEASON IN RAINBOW TROUT (Salmo gairdneri Richardson). Roczniki Nauk Rolniczych, Series H - Fisheries, 94(1): 57-68. In English.

A change in the cycle of daytime duration, and thus a change of the conditions of illuminating rainbow trout brings about changes in their gonad development; it acts primarily during the stage of rapid oocyte growth. The accelerated light cycle caused significantly earlier maturation in all of the males, whereas in females maturation was accelerated maximally by 4 months and 22 days, but part of them did not react at all to the change in the light cycle. Changes of the light cycle in winter, that is, in the period directly preceding the normal spawning season did not affect gonad development in rainbow trout. It seems that success of the test on shifting the spawning from spring to autumn or winter depends, besides the light regime, also on the water temperature, at least in the period preceding the expected spawning.

15247. Goryczko, Krzysztof (Inst. Rybactwa Śródlądowego, Terenowa Pracownia Rzeczna, Poland). 1972. INCUBATION OF EGGS FROM THE AUTUMN SPAWNING OF RAINBOW TROUT (Salmo gairdneri Richardson). [Inkubacja jaj, Pochodzących z Jesiennogo Tarła Pstrąga Tęczowego (Salmo gairdneri Richardson)]. Roczniki Nauk Rolniczych, Series H - Fisheries, 94(1): 69-80. (In Polish with English summ.)

The material for tests comprised: (a) rainbow trout eggs obtained in November and December as a result of acceleration of spawning in the way of applying a controlled length of day in the years 1963-1965; (b) eyed eggs of the rainbow trout strain spawning in autumn, imported from France to the River Field Station in Oliwa. The problem of egg incubation was investigated under conditions of low water temperature. High losses in eggs and hatch were observed. Significant losses in the period up to eyeing could be caused by factors such as, for example, hypophization of spawners or the low vitality of eggs obtained from spawners at the River Field Station. However, the main factor causing high mortality in the eggs used for tests was the low water temperature during the incubation period. The spawn was incubated in water with normal temperature, with a constant temperature of 6°C, and heated by about 2°C. The results of the test show that: (a) the water temperature of 4°C is the threshold value during the period of embryonal development, and the temperature of 6°C in the first stages of the post-embryonal period; (b) the incubation period for the eggs of rainbow trout originating from the autumn spawning is longer than in the case when they originate from the spring spawning; it seems that the length of this period measured in degree days is approximate to the length of the incubation period of brook trout eggs. (Auth. summ.) -- Translated by B. Jankowski.

15248. Goryczko, Krzysztof (Inst. Rybactwa Śródlądowego, Terenowa Pracownia Rzeczna, Poland). 1972. THE GROWTH RATE OF RAINBOW TROUT (Salmo gairdneri Richardson) FROM THE AUTUMN AND SPRING SPAWNING. [Wzrost Pstrągów Tęczowych (Salmo gairdneri Richardson) Pochodzących z Jesiennogi i Wiosennogo Tarła).] Roczniki Nauk Rolniczych, Series H - Fisheries, 94(1): 81-96. (In Polish with English summary).

In the River Field Station at the Inland Fisheries Institute in Oliwa, in the years 1965-1967, the growth of rainbow trout spawning in the spring and in the autumn was compared. The growth of fishes used for the tests was analyzed mainly taking only one factor into account, that is, the water temperature. For the purpose of comparing the growth of fishes reared in various temperature conditions, the thermal growth rate coefficient "k" was used: $k = \frac{\ln W_t - \ln W_o}{D^\circ - x}$, where: W_t — weight W at the time t, W_o — initial weight, D° — number of degree days, x — product of the number of days and the temperature amounting to 3°C, assumed as the temperature below which trout stop growing. It was found that shift of the spawning in rainbow trout from the spring months to the autumn months gives a marked shortening of the breeding period of the stock material obtained in this manner. It was also found that the thermal conditions prevailing in the River Field Station from the end of April till June ensure the rapid growth of hatch stocked in the pond. (Auth. Summ.) -- Translated by B. Jankowski.

15249. Wojno, Tadeusz (Wyższa Szkoła Rolnicza w Olsztynie, Katedra Rybactwa, Poland). 1972. THE EFFECT OF STARVATION AND VARIOUS DOSES OF FODDER ON THE CHANGES OF BODY WEIGHT AND CHEMICAL COMPOSITION AND THE SURVIVAL RATE IN RAINBOW TROUT FRY (Salmo gairdneri Richardson) DURING THE WINTER. [Wpływ Głodowania i Różnych Dawek Paszy na Ciężar, Skład Chemiczny i Przeżywalność Narybku Pstrąga Tęczowego (Salmo gairdneri Richardson) w Okresie Zimowania]. Roczniki Nauk Rolniczych, Series H - Fisheries, 94(1): 125-138. (In Polish with English summary).

In the period from January 7 to March 30, 1967, tests were carried out aimed at determining the effect of starvation as well as the use of various doses of fodder on the changes of body weight and chemical composition and of the survival rate in rainbow trout fry. The fry was investigated in 2 size groups. Each of these groups was divided into 3 subgroups. In one of these subgroups the trout fry was not fed, and in the second group it was fed with fodder in 24 hour doses amounting to 1.5% of weight of the fish stock, and in the third group – in doses amounting to 3% of weight of the stock. The particular groups were tested in 3 repetitions. The tests showed that during the winter period both in the body of the fed fry and of the unfed fry the fat content by percentage decreased, whilst the protein content increased. The dynamics of these changes depended on the water temperature, fish sizes and on the quantity of consumed fodder. The conducted tests confirm the observations of other authors on the growth of rainbow trout fry in low water temperatures. The so-called "growth threshold" for smaller fry is higher (about 3°C). Heavier fry (with mean individual weight of 8 g) started growth in a water temperature of about 2.5°C. Starved fry as well as that receiving fodder in various doses was marked by a high survival rate. Slight changes in the chemical composition, minimum increments of the body weight of fishes at the temperature up to 3°C and the high survival rate indicate that administration of fodder to rainbow trout fry is unjustified under such conditions. (Auth. summ.) -- Translated by B. Jankowski.

15250. Saha, Jadu, and Young W. Lee (Canada Agric. Res. Sta., Univ. Campus, Saskatoon, Saskatchewan, Canada). 1972. INTERFERENCE OF FATS IN THE DETERMINATION OF MERCURY RESIDUES IN FISH BY ATOMIC ABSORPTION SPECTROMETRY. Bull. Environ. Contamination and Toxicology, 7(5): 301-304.

In the wet oxidation methods of determining mercury in fish tissue any fat remaining in the digests can interfere in the estimation of mercury by atomic absorption spectrometry and give high values. This interference can, however, be easily removed by extraction of the digests with chloroform prior to the recovery of mercuric ions with dithizone.

15251. Thomas, Andrew J., and Stuart Patton (Lipids Lab., Penn. State Univ., University Park, Pennsylvania 16802). 1972. PHOSPHOLIPIDS OF FISH GILLS. Lipids, 7(1): 76-78; Comm. Fish. Abstr., 25(6): p. 17.

Lipids were extracted from nine species of fish and the individual phospholipids as a percentage of the total were determined. The fish tested were coho salmon, pink salmon, kelp bass, sand bass, whitefish, sheepshead, Pacific rattail, and flatnose codling. The pattern of composition of the phospholipids in the gill filaments of the fish did not appear to vary among the fish living at greatly differing ocean depths; also, the pattern did not appear to vary between pre- and postspawning salmon.

15252. Koshinsky, Gordon D. (Sask. Fish. Lab., Saskatoon, Saskatchewan, Canada). 1972. AN EVALUATION OF TWO TAGS WITH NORTHERN PIKE (Esox lucius). J. Fish. Res. Bd. Canada, 29(5): 469-476.

In a 4-year study of northern pike (Esox lucius) at Lac la Ronge, Sask., barb-anchored spaghetti dart tags (when applied with special needles and disinfectant) were retained longer than monofilament-attached preopercular disc tags. Losses after 2 years were 13 and 92%, respectively. Tagging mortality tended to be higher among dart-tagged individuals, but was only 12% after 2 years. Condition tended to be depressed by both tags and, among females, more so by the preopercular discs. Growth increments tended to be smaller for disc-tagged than for dart-tagged individuals of the same sex. Disc-tagged pike also dispersed more widely and were more vulnerable to angling. It is suggested that a brightly colored tag attached to the head of a predatory species, such as pike, interferes with feeding, perhaps by startling prey; such interference would explain all of the comparative tagging effects observed. (Auth.)

15253. Brown, E. H., Jr. (Great Lakes Fish. Lab., U. S. Fish and Wildl. Serv., Ann Arbor, Michigan 48107). 1972. POPULATION BIOLOGY OF ALEWIVES, Alosa pseudoharengus, IN LAKE MICHIGAN, 1949-70. J. Fish. Res. Bd. Canada, 29(5): 477-500.

Alewives were unknown in Lake Michigan before 1949, but became extremely abundant in the 1960s and soon exceeded the carrying capacity of the lake. In 1967 they were decimated by a lakewide mass mortality, and have since been less abundant as "adults" ($\geq$120 mm long), although numerous young were produced in 1967-70 and the adult population appeared to be gradually increasing. Alewives were studied intensively during 1962-70 on the basis of collections made primarily with bottom trawls. Principal considerations in the population study include effects of seasonal changes in distribution on length composition of young and adults, sex and maturity in relation to size and age at recruitment into adult stocks, and changes in age, growth, condition, and population structure that accompanied the drastic changes in abundance. A substantial increase in the age of adults in the bottom stocks and on the spawning grounds was among the important population changes after the 1967 die-off. Growth of older adults also increased appreciably immediately after the die-off, and a sharp increase in average weight (16-26%) over a standard range of lengths was maintained in 1968-70. Selective depletion of zooplankton by alewives was evidence that overabundance decreased the food supply, depressed growth and caused the poor condition that made alewives vulnerable to excessive mortality in 1967. Although poor condition in fall undoubtedly increased winter and spring mortality in the mid-1960s, alewives apparently were stressed by below-average temperature in the winter of 1969-70, and experienced a light die-off through May 1970 despite their good condition and relatively low population density the preceding fall. The population upsurge that preceded the 1967 die-off was reflected by a fivefold increase of adults in the fall index catch (in trawls) from 1962 to 1965 and 1966. The index catch then dropped 70% in fall 1967. Mortality among the 1960-64 year-classes, as represented by annual losses from age III to age IV in the index catch during 1964-68, ranged from 40% in 1965 to 89% in 1967, and averaged 68%. Assessment of mortality from the index catches was difficult because the age of alewives at full recruitment into bottom stocks increased from III in the mid-1960s to IV or older in 1968-70, when alewives remained longer at midlevels, possibly because of a delay in sexual maturity. Annual

mortality after the fifth year of life, on the basis of average percentage age composition of the trawl catches in 1964-70, was tentatively estimated as 79-80%. The number of alewives recruited to the adult population from the 1962-67 year-classes over several ages in the fall index catch was inversely related to the abundance of their parents in the fall immediately preceding the year in which each year-class was spawned. Annual commercial production in the 1960s (peak in 1967, 43 million lb) may not have exceeded 7.7-18.6% of the bottom stocks, on the basis of the estimated weights of alewives available to trawls in the spring of 1964 and 1969. Yield per recruitment to the commercial fishery was low because of slow growth and high natural mortality. (Auth.)

15254. Li, M. F., and G. S. Traxler (Fish. Res. Bd. Canada, Halifax Lab., Halifax, Nova Scotia, Canada). 1972. TISSUE CULTURE BIOASSAY METHOD FOR WATER POLLUTION WITH SPECIAL REFERENCE TO MERCURIC CHLORIDE. J. Fish. Res. Bd. Canada, 29(5): 501-505.

The effect of $HgCl_2$ on multiplication and respiration of L-cells cultivated in suspension was studied. The nutritional history, growth phase, initial density of the cells, as well as the concentration of the serum supplement used in the test medium had significant effects on the sensitivity of the bioassay system. We concluded that the cells used for the test should be in the stationary phase at an initial cell density of approximately 2×10^5 per milliliter, and the test medium should be free of fetal calf serum. Under our experimental conditions mercuric chloride at a concentration of 10 μg/liter or less inhibited the cellular multiplication significantly; the results indicated that this assay procedure could be adequate for monitoring water quality. The cellular respiration method, however, was less sensitive, but simple and rapid with results being made available within a few hours, and therefore useful for screening or preliminary testing of heavily polluted samples. (Authors)

15255. Fortin, R., and E. Magnin (Univ. of Montreal, Montreal 101, Quebec, Canada). 1972. LENGTH AND WEIGHT GROWTH OF THE PERCH Perca flavescens OF GREAT BAY OF PERROT ISLAND IN LAKE SAINT-LOUIS. (Croissance en longueur et en poids des perchaudes Perca flavescens de la Grande Anse de l'ile Perrot au lac Saint-Louis). J. Fish. Res. Bd. Canada, 29(5): 517-523.

In this study, growth in length is based upon age determination on the opercular bones of 2170 specimens, collected throughout the year from June 1967 to October 1969. The opercular bone shows allometric growth and this is taken into account in back calculations. Grande Anse perch show comparatively rapid growth. Growth of males is slower than that of females. Seasonal growth extends from May to September. Faster growing fish reach sexual maturity earlier in life. Length-weight relationship exponent is 3.107. Due to the weight of the gonads, female perch show maximum condition index values in winter. (Authors)

15256. Reinert, Robert E., Donald Stewart, and Harry L. Seagran (U. S. Fish and Wildl. Serv., Great Lakes Fish. Lab., Ann Arbor, Michigan 48107). 1972. EFFECTS OF DRESSING AND COOKING ON DDT CONCENTRATIONS IN CERTAIN FISH FROM LAKE MICHIGAN. J. Fish. Res. Bd. Canada, 29(5): 525-529.

Concentrations of DDT residues were highest in parts of the body with the highest oil content in four species of fish from Lake Michigan: yellow perch (Perca flavescens), bloater (Coregonus hoyi), lake trout (Salvelinus namaycush), and coho salmon (Oncorhynchus kisutch). Dressing reduced the DDT residues and oil content by more than 90% in yellow perch but had little effect in the other three species. The concentration of DDT residues in bloaters was changed little by smoking but was reduced 64-72% by other methods of cooking: from 8.0 ppm (raw) to 2.2 ppm after frying in corn oil; from 10.7 to 3.9 ppm after frying in lard; and from 9.1 to 3.2 ppm after broiling. The concentration of DDT residues in fillets of yellow perch changed only from 0.3 ppm (raw) to 0.4 or 0.5 ppm after baking, frying, or broiling. (Authors)

15257. Hinton, David E., Robert L. Snipes, and Michael W. Kendall (Dept. of Anatomy, School of Medicine, and Water Res. Lab., Univ. of Louisville, Louisville, Kentucky 40202). 1972. MORPHOLOGY AND ENZYME HISTOCHEMISTRY IN THE LIVER OF LARGEMOUTH BASS (Micropterus salmoides). J. Fish. Res. Bd. Canada, 29(5): 531-534.

Livers of 27 bass collected from streams and an impoundment in Kentucky were subjected to light and electron microscopic as well as enzyme histochemical examination. The connective tissue framework of the liver was primarily collagen and reticulum. Elastic lamellae were seen in hepatic arteries. Hepatic parenchyma was arranged in dual-plated muralia. Hepatocytes contained glycogen, endoplasmic reticulum, mitochondria, and a homogeneous nucleus with one prominent nucleolus. Pancreatic acini were observed in walls and perivascular connective tissue of portal veins. No distinct lobular pattern of parenchyma was observed. The enzyme glucose-6-phosphatase was abundant in cytoplasm of hepatocytes usually forming a perinuclear cuff. Alkaline phosphatase was determined in the sinusoidal border of hepatocytes and in walls of central veins. Differentiation of portal veins from central veins was made on the basis of proximity to the hepatic artery and bile duct. (Authors)

15258. Hurley, Donal A. (Ont. Dept. of Lands and Forests Res. Branch, Maple, Ontario, Canada). 1972. THE AMERICAN EEL (Anguilla rostrata) IN EASTERN LAKE ONTARIO. J. Fish. Res. Bd. Canada, 29(5): 535-543.

The life history of eels in Lake Ontario was studied by measuring, tagging, and releasing about 1500 individuals between 1958 and 1966. The smallest eels captured were from 295 to 318 mm long. Presumably they entered the lake at about age III-IV at lengths of 200-300 mm. Otoliths of eels from the lake showed a range in age between IV and XVIII, while those of smaller eels from the Ottawa River ranged between age II and IX. The length-weight regressions showed two distinct growth phases: one from about 480 mm to 790 mm, the other from about 830 mm to 1080 mm. Growth of the orbital diameter, interorbital distance, and pectoral fin length in relation to total length was not obviously related to sexual maturity. Eels that emigrated from the lake had a greater weight-length ratio than those that remained in the lake for another year. Of 917 tagged eels transplanted within Lake Ontario, 28 were recaptured near and 18 recaptured far from the original capture site. Although the results are inconclusive, there is a suggestion that eels have home territories within the lake. (Auth.)

15259. Schutz, D. C., and T. G. Northcote (Inst. of Animal Res. Ecol., Univ. of Brit. Columbia, Vancouver, British Columbia, Canada). 1972. AN EXPERIMENTAL STUDY OF FEEDING BEHAVIOR AND INTERACTION OF COASTAL CUTTHROAT TROUT (Salmo clarki clarki) AND DOLLY VARDEN (Salvelinus malma). J. Fish. Res. Bd. Canada, 29(5): 555-565.

Feeding behavior of cutthroat trout (Salmo clarki clarki) and Dolly Varden (Salvelinus malma) cohabiting a small coastal lake was studied experimentally to examine the importance of food exploitation as a mechanism for spatial and food segregation observed there. The hypothesis that Dolly Varden could feed more successfully on benthic prey, and cutthroat on surface prey was supported by laboratory experiments involving isolated individuals and interspecies pairs exposed to food in benthic, surface, and both locations. Differences between the species were found in resting and orientation positions and in behavior associated with food searching, location, and capture. Dolly Varden also were more successful than cutthroat in capturing benthic prey at low light intensities. Observed differences in feeding between the species were fully expressed in solitary individuals and did not appear to be magnified by interaction. It is suggested that these differences in sympatric stocks of the two species may be inherent and, therefore, that segregation is largely selective rather than interactive, even though the populations still retain considerable plasticity, enabling them to change diets or habitats when necessary or advantageous. (Authors)

15260. Trust, T. J. (Dept. of Bacteriology and Biochemistry, Univ. of Victoria, Victoria, British Columbia, Canada). 1972. THE BACTERIAL POPULATION IN VERTICAL FLOW TRAY HATCHERIES DURING INCUBATION OF SALMONID EGGS. J. Fish. Res. Bd. Canada, 29(5): 567-571.

During the incubation period, the number of bacteria on the surface of salmonid eggs in vertical tray hatchery stacks varied between 4.8×10^3 and 10^7 aerobic organisms per square centimeter of egg surface. The bacterial count in the tray water varied between 1.1×10^3 and 5.4×10^5 organisms per milliliter. The most common isolates from the eggs were species of Cytophaga and Pseudomonas. Aeromonas hydrophila was also isolated. These species remained on the eggs throughout incubation, and were also isolated from tray surfaces and tray water. (Auth.)

15261. Chiszar, David, Mark Moody, and J. T. Windell (Lab. of Animal Physiol. and Behavior, Univ. of Colo., Boulder, Colorado 80302). 1972. FAILURE OF BLUEGILL SUNFISH, Lepomis macrochirus, TO HABITUATE TO HANDLING. J. Fish. Res. Bd. Canada, 29(5): 576-578.

Two experiments measured changes in breathing rate in bluegill sunfish (Lepomis macrochirus) after several forms of routine daily handling. Both experiments revealed large increases in this measure after handling. However, the magnitude of this response did not diminish during 10 days of handling. Thus, the bluegill's respiratory response does not readily habituate to these treatments. (Authors)

15262. Davisson, Muriel Trask (Dept. of Biol., Penn. State Univ., University Park, Pennsylvania 16802). 1972. KARYOTYPES OF THE TELEOST FAMILY ESOCIDAE. J. Fish. Res. Bd. Canada, 29(5): 579-582.

Representatives of all five surviving species in the teleost family Esocidae, including pikes, pickerels, and muskellunge, and two interspecific hybrids were found to have karyotypes consisting of 50 acrocentric chromosomes. The karyotypic similarity suggests a cytological basis for the ease of hybridization observed among most members of this family and shows that speciation can occur without karyotypic change. Evolutionary implications are discussed. (Auth.)

15263. Carlson, A. R. (U. S. Environ. Protection Agency, Nat. Water Qual. Lab., Duluth, Minnesota 55804). 1972. EFFECTS OF LONG-TERM EXPOSURE TO CARBARYL (SEVIN) ON SURVIVAL, GROWTH, AND REPRODUCTION OF THE FATHEAD MINNOW (Pimephales promelas). J. Fish. Res. Bd. Canada, 29(5): 583-587.

When fathead minnows (Pimephales promelas) were exposed to five concentrations (0.008-0.68 mg/liter) of the insecticide carbaryl for 9 months and throughout a life cycle, the highest concentration prevented reproduction and decreased survival. At the high concentration, testes contained motile sperm and ovaries were in a flaccid condition and appeared to be in a resorptive state. At the 0.68 mg/liter concentration, carbaryl appeared to contribute to mortality of larvae (produced by unexposed parents) within 30 days of hatching. Survival of young grown in the 0.008 mg/liter concentration was reduced. Since no demonstrable effects were noted for survival, growth, or reproduction at the 0.017, 0.062, and 0.21 mg/liter concentrations, this low survival value is considered not due to carbaryl. The 96-hr median tolerance concentration (TL 50) and the lethal threshold concentration (LTC) for 2-month-old fathead minnows were 9.0 mg/liter. The maximum acceptable toxicant concentration (MATC) for fathead minnows exposed to carbaryl in water with a hardness of 45.2 mg/liter and a pH of 7.5 lies between 0.21 and 0.68 mg/liter. The application factors (MATC/96-hr TL50 and MATC/LTC) both lie between 0.023 and 0.075. (Auth.)

15264. Lindsey, J. K., and F. W. Nash (Fish. Res. Bd. Canada, Biol. Sta., Nanaimo, British Columbia, Canada). 1972. LIKELIHOOD ANALYSIS OF THREE-WAY CONTINGENCY TABLES. J. Fish. Res. Bd. Canada, 29(5): 590-591.

The three-way contingency table is considered as an analysis of variance problem. Since the appropriate distribution is multinomial rather than normal, the log likelihood ratios are used to make inferences instead of the variance ratios. (Authors)

15265. Willis, D. E., and R. F. Addison (Fish. Res. Bd. Canada, Mar. Ecol. Lab., Bedford Inst., Dartmouth, Nova Scotia, Canada). 1972. IDENTIFICATION AND ESTIMATION OF THE MAJOR COMPONENTS OF A COMMERCIAL POLYCHLORINATED BIPHENYL MIXTURE, AROCLOR 1221. J. Fish. Res. Bd. Canada, 29(5): 592-595.

The major compenents of Aroclor® 1221, a polychlorinated biphenyl mixture, have been tentatively identified as the following (weight % composition of each component is given in parentheses): biphenyl (12.7), 2-chlorobiphenyl (28.4), 4-chlorobiphenyl (18.7), 2,2'-dichlorobiphenyl (9.2), 2,4-dichlorobiphenyl (3.5), 2,4'-dichlorobiphenyl (13.6), and 4,4'-dichlorobiphenyl (6.2). (Authors)

15266. Sylvester, J. R. (Univ. of Wash., College of Fisheries, Seattle, Washington 98105). 1972. EFFECT OF THERMAL STRESS ON PREDATOR AVOIDANCE IN SOCKEYE SALMON. J. Fish. Res. Bd. Canada, 29(5): 601-603.

Under laboratory conditions, predation rates of yearling coho salmon (Oncorhynchus kisutch) on sockeye salmon fry (Oncorhynchus nerka) increased with increasing acclimation temperature. Elevated temperature doses significantly decreased survival of sockeye salmon fry. The results suggest that under natural conditions, sudden increases in water temperature could alter predator-prey interactions of some fish by increasing predation mortalities. (Auth.)

15267. Merritt, Robert B. (Dept. of Systematics and Ecol., Univ. of Kansas, Lawrence, Kansas). 1972. GEOGRAPHIC DISTRIBUTION AND ENZYMATIC PROPERTIES OF LACTATE DEHYDROGENASE ALLOZYMES IN THE FATHEAD MINNOW, Pimephales promelas. The American Naturalist, 106(948): 173-184.

A two-allele Ldh^a locus polymorphism is described in Pimephales promelas. A north-south cline in gene frequency at the A locus is documented, and kinetic studies on the three LDH genotypes are described which search for a functional basis for maintenance of the polymorphism and the cline. The LDHs of the homozygote for the northern allele possess significantly higher Michaelis constants for pyruvate (lower substrate affinities) than LDHs of the other two genotypes at 25°C and above. Frequency of occurrence of the northern allele in nature fits the distribution expected from observed Michaelis constants. Results indicate that selection is acting at this locus and that substrate affinity is an adaptively significant enzymatic property. (Auth. summ.)

15268. Tanaka, Masaru (Dept. of Fish., Fac. of Agric., Kyoto Univ., Kyoto, Japan). 1971. STUDIES ON THE STRUCTURE AND FUNCTION OF THE DIGESTIVE SYSTEM IN TELEOST LARVAE - III. DEVELOPMENT OF THE DIGESTIVE SYSTEM DURING POSTLARVAL STAGE. Jap. J. Ichthyol., 18(4): 164-174.

The digestive organs of postlarvae in 13 teleost species chiefly reared in laboratory were compared with one another to make clear their developmental processes. After the start of feeding two conspicuous features appear in the epithelium of the intestine. One is the appearance of many vacuoles in the anteromedian part of intestine, and the other is acidophilic granules in the posterior part of intestine. The posterior constriction with valvular structure forms the border between the two parts of the intestine. The age when gastric gland differentiates varies from species to species. Pyloric caeca appear following the completion of gastric gland. At the period when pyloric caeca differentiate, fishes are at the transitional stage from larvae to juveniles. At this time body forms are regulated to approach basic forms of their adults, and all fins are completed. The digestive system of postlarvae is stomachless in structure, and may be at the undifferentiated state in function. Therefore it may be speculated that larvae have characteristic digestive mechanisms different from those of adults. (From Auth.)

15269. So, Bernard K. F. (Dept. of Biol., Memorial Univ. of Newfoundland, St. John's, Newfoundland, Canada). 1972. MARINE FISH HAEMATOZOA FROM NEWFOUNDLAND WATERS. Canad. J. Zool., 50(5): 543-554.

Of 797 fish of 28 species, 159 of 12 species yielded blood protozoa. Trypanosoma rajae is recorded from Raja radiata. Undetermined trypanosomes are

are reported from Glyptocephalus cynoglossus and Gadus morhua, respectively. Haemogregarina myoxocephali is listed from the type host, Myoxocephalus octodecemspinosus. The occurrence of haemogregarine sporozoites (perhaps of this species) in the gut of a piscicolid leech (Malmiana nuda) from Myoxocephalus scorpius represents the first discovery of a potential vector of any fish haemogregarine. New hosts are listed for Haemogregarina delagei and H. platessae. A babesioid Haemohormidium terraenovae n. sp. is described from six hosts: Ammodytes americanus, Urophycis tenuis, Melanogrammus aeglefinus, Limanda ferruginea, Glyptocephalus cynoglossus, and Hippoglossoides platessoides; and another, Haemohormidium beckeri n. sp., from Myoxocephalus octodecemspinosus. (Auth.)

15270. Sekizawa, Yasuharu, Takahiko Kikuchi, and Akira Suzuki (Res. Labs., Meiji Seika Kaisha, Ltd., Morooka-cho, Kōhoku-ku, Yokohama, Japan). 1971. ELECTROPHYSIOLOGICAL SURVEYS ON THE ANESTHETIC PROPERTIES OF 2-AMINO-4-PHENYLTHIAZOLE UPON CARP (Cyprinus carpio). Jap. J. Ichthyol., 18(3): 128-138. In Japanese with English abstract.

Surveys were performed regarding the electrophysiological characteristics of inhalation anesthesia with 2-amino-4-phenylthiazole upon carp (Cyprinus carpio Linnaeus). Major centrifugal nerve-muscle systems (such as spinal nerve with levator muscle of anal or pectoral fin and cerebral nerve with mandibular muscle) and major sensory organs with centripetal nerve systems (such as olfactory organ with its nerve, eye with optic nerve, labyrinth with the VIII nerve and lateral organs with the X nerve) were observed to be still electrophysiologically active under the anesthetized condition. Any detrimental effect upon heart beating under the anesthetized condition was not observed so far with the electrocardiograms directly derived from the exposed hearts. Any depressive effect on the action potential of an isolated preparation of postesophageal ample of the alimentary canal was not observed by the direct application of the compound in Masugi's solution. The electroretinogram under the anesthetized condition was still normal. The electrical response of optic lobe of midbrain was also still normal under the anesthetized condition when an eye in the opposite side was irradiated by incandescent lamp. Temporary depressive effects observed in the extent of the present investigation were summarized as follows: (1) Although the inhibitory effect on the function of the olfactory system (from olfactory organ to its nerve via olfactory bulb) was not observed, the electrical response of forebrain seemed to be weakened under anesthetized condition. This was reinforced by the direct application of the compound into forebrain by fine glass capillary. The direct application upon the isolated axon of olfactory nerve did not give the depressive effects. (2) Although the inhibitory effect on the acousticolateral system was not observed, the induced action potentials around the frontal side of medulla oblongata (near pons) seemed to be weakened under the anesthetized condition when spinal cord was electrically stimulated. The same depressive effect was observed only by the direct application of the compound into inferior lobe of interbrain with fine glass capillary. (3) Spontaneous 16-18 Hz wave derived from the center part of cerebellum was rapidly disappeared and reappeared in the anesthesia and its recovering process. This was also reinforced by the direct application into cerebellum. (4) Under critical condition at inhalation anesthesia such as in the application of high concentration and/or a long time run, autonomic characteristic of respiratory center seemed to be disordered, and finally a paralysis in the center caused death. The direct application of the compound into deep position of pons caused a seizure type discharge similar to the case of the critical treatment under inhalation anesthesia. Under the anesthesia in an appropriate grade, the oxygen uptake due to respiration was decreased to one fourth of that under vigorous swimming condition and was approximately equal to the oxygen uptake under the stationary condition. The above experimental evidences seemed to imply that the characteristic of inhalation anesthesia caused by 2-amino-4-phenylthiazole upon carp should be attributed to its centrally acting mechanism. (Authors)

15271. FAO of the United Nations (Rome, Italy). 1972. FAO AQUACULTURE BULLETIN. A QUARTERLY NEWS DIGEST OF AQUACULTURE RESEARCH AND DEVELOPMENT. FAO Aquacult. Bull., 4(2): 28 p., illus.

Contents include: From research institutions ... Out-of-season spawning of grey mullet - Storage of pituitary extract for induced spawning - Artificial propagation of the grey mullet - Induced breeding of Clarias spp. - Induced spawning of grass carp - Propagation of freshwater prawn - Shrimp pond fertilization - Ascorbic acid in catfish feeds - Catfish processing plant waste for fish feed - Bohemeria leaves as fish food - Use of demand feeders - Control of aquatic weeds - Catfish culture in raceways - Catfish culture in brackish-water ponds - Sea farming of coho salmon - Shrimp culture - Tuna culture - Polyculture of fish - Oyster culture - Thinning of whitefish populations in ponds. Aquaculture development ... Australia - Cameroon - France - Germany, Fed. Rep. of - Israel - Japan - Kenya - Korea, Rep. of - Nepal - Nigeria - Norway - Poland - Taiwan - Uganda - United Kingdom - United States. Fish diseases and their control ... Whirling disease control - Parasite on grass carp - Trout virus outbreak in Oregon - Aquatic Animal Medicine Committee - Aquatic Animal Medicine Laboratory - Diagnostic and research laboratory for fish diseases. Fish and shellfish introductions ... Recent introductions - Evaluation of species introduced in Victoria, Australia. (From contents)

15272. Saddler, J. B., K. V. Koski, and R. D. Cardwell (Fish. Res. Inst., Univ. of Wash., Seattle, Washington 98195). 1972. FATTY ACID ALTERATIONS DURING MIGRATION AND EARLY SEA WATER GROWTH OF CHUM SALMON (Oncorhynchus keta). Lipids 7(2): 90-95; Comm. Fish. Abstr., 25(6): p. 18.

This study was conducted in May and June of 1968. The purpose was to examine the fatty acid characteristics and lipid contents of chum salmon fry during their early development in fresh water, seaward migration, and early sea-water growth. Extensive residence (2-3 weeks) of the fry in fresh water resulted in a fatty acid pattern in the fish more characteristic of fresh-water fish; residence of fry in sea water resulted in fatty acid patterns characteristic of marine fish. The fry introduced artificially into sea water incurred substantial diminutions in their content of polyunsaturated fatty acids.

15273. Collins, Richard A. (State Coll. of Ark., Conway, Arkansas 72032). 1971. CULTURING TROUT IN CAGES. Ark. Game and Fish Comm., Little Rock, Ark., Report 12 pp.; NOAA Publications Announcement No. 72-5, Item 72-05-16-04, 1972; Comm. Fish. Abstr., 25(7): p. 18.

The major objectives were to determine (1) the feasibility of culturing rainbow trout in cages from fingerlings to edible size during the cooler months of the year in warm-water lakes, (2) the proper stocking density in the cages, and (3) the economic feasibility of culturing trout in cages. Triplicate tests were made using cages stocked with 400, 600, and 700 rainbow trout fingerlings averaging 59 g. each. After 115 growing days with 6 day/week feeding, the average weight of fishes in all cages was 163 g. One cage of selected fish was fed for an additional 34 days. These fish attained an average weight of 261 g. Food conversion during the majority of the experiment was 1.54. No significant reduction in feed consumption or growth was noted when water temperatures dropped to as low as 3.5°C; however, temperatures of 2°C or lower produced a noticeable lag in feed consumption and growth rate. The cages with the highest stocking densities showed no reduction in rate of growth or feed conversion over the cages with lesser stocking densities. Economic considerations indicate favorable profit potential in some situations for the culture of trout in cages during the winter in warm-water lakes. (Auth.)

15274. Collins, Richard A. (State Coll. of Ark., Conway, Arkansas 72032). 1971. DEVELOPMENT OF THE CAGE CULTURE METHOD OF FISH PRODUCTION FOR COMMERCIAL USE IN LARGE RESERVOIR LAKES. Ark. Game and Fish Comm., Little Rock, Ark., Report, 13 pp.; NOAA Publications Announcement No. 72-5, Item 72-05-16-05, 5, 1972; Comm. Fish. Abstr., 25(7): p. 17.

Four different cage designs ranging in volume from 3 to 12 cubic yards were

each stocked with 300 fingerling catfish per cubic yard to determine the effects of the different cage sizes on growth and conversion of the fish. Fingerlings were graded to a uniform size before being stocked in an attempt to eliminate the differential growth. Results indicate that in large reservoir lakes the cage size can be unlimited in surface area and as deep as the water containing adequate dissolved oxygen. The depth of the cages had no important bearing on the growth rate, and in the cages with the greater surface area the catfish grew more rapidly and converted food better. It was concluded that differential growth of catfish in cages is a result of initial variance of the fingerling fish and not to hierarchy. Large numbers of wild fish around the cages caused problems of loss of food and possibly introduction of diseases. The wild fish can, however, be effectively trapped in the area of the cages. The economic evaluation indicates the following situations: (1) a small-scale operation incorporated into an existing business such as a marina, and (2) a very large-scale operation (200,000 or more fish). (Auth.)

15275. Reichenbach-Klinke, H.-H., and R.-D. Negele. 1971. THE INFLUENCE OF TAPEWORMS ON THE FLESH OF WHITEFISH AND TROUTS. (Untersuchungen über den Bandwurmbefall von Nutzfischen im Hinblick auf die Beeinträchtigung des Nahrungsmittels Fisch). Berliner und Münchener Tierärztliche Wochenschrift, 84(20):396-399, illus. In German with English summary.

By means of measurements the influence of tapeworms of the genera Proteocephalus, Triaenophorus and Ligula is demonstrated. The infestation by Proteocephalus, Triaenophorus or Ligula is followed directly or indirectly by a decrease of growth, an inhibition of enzymes and blood-damage. Triaenophorus crassus and probably also Proteocephalus ssp. diminish the carotinoid content of flesh. The concentration of Triaenophorus crassus in the flesh of whitefish and trouts is a problematic question in view of the hygienic aspect. (Authors summ.)

15276. Brylińska, Maria, and Witold Białokoz (Wyższa Szkoła Rolnicza w Olsztynie, Katedra Zoologii Ogólnej, Poland). 1972. GROWTH AND FECUNDITY OF BREAM (Abramis brama L.) IN OTMUCHOV DAM RESERVOIR. (Wzrost i Płodność Leszcza (Abramis brama Linnaeus) w Zbiorniku Zaporowym w Otmuchowie). Roczniki Nauk Rolniczych, 94(1): 41-55. In Polish with English summary.

Investigations concerned growth and fecundity of bream in Otmuchov dam reservoir. Samples were collected in April and May 1968 and 1969. Fish were caught with the use of gill and trap nets. According to the collected material, the ratio of females to males on the spawning grounds was 1:2. Gonads used for fecundity studies were in the V-th state of development, according to Maier's scale. They were fixed with formalin. Fecundity was estimated by the weight method. Eggs were separated from the ovary, dried, and weighed with an accuracy of 0.01 g; samples of eggs - of 0.0001 g. Rate of growth was calculated according to Dahl Lea's method; corrections were made according to the empirical curve. Basing upon the investigations it was found that the bream in Otmuchov dam reservoir is characterized by lower than average rate of growth, as calculated for Polish Lakes. Rate of growth of older bream from Otmuchov dam reservoir evidently decreases as compared with other data. Evident decrease of the bream's rate of growth was also found in 1968 and 1969, as compared to previous years. Such a situation is caused by progressing pollution of the environment. Absolute and relative fecundity of bream from Otmuchov dam reservoir is lower than average for other Polish lakes (according to both length and weight classes.) Low fecundity of bream in this reservoir is caused by slow rate of growth and by its condition. A positive correlation was found between absolute fecundity of the bream and the females' length and body weight. -- Translated by B. Jankowski.

15277. FAO of the United Nations (Rome, Italy). 1972. A LIST OF SCIENTIFIC AND SEMI-POPULAR PERIODICALS ON INLAND FISHERIES AND AQUACULTURE. FAO Fisheries Circular, No. 311 (Rev. 1), 7 p.

15278. FAO of the United Nations (Rome, Italy). 1972. REPORT OF THE FOURTH SESSION OF THE FAO PANEL OF EXPERTS FOR THE FACILITATION OF TUNA RESEARCH. FAO Fisheries Reports, No. 118, 23 p.

15279. Ryder, R. A. (Ont. Dept. of Lands and Forests, Res. Branch, Thunder Bay, Ontario, Canada). 1972. THE LIMNOLOGY AND FISHES OF OLIGOTROPHIC GLACIAL LAKES IN NORTH AMERICA (ABOUT 1800 A. D.). J. Fish. Res. Bd. Canada, 29(6): 617-628.

The general limnology and fish composition of 14 North American oligotrophic lakes is described as it likely was about the year 1800, prior to the adverse effects of man-made eutrophication, exploitation, and introductions of exotic species. The general description includes glacial history and geomorphology, climate and growing season, morphometry of the lake basins, physical and chemical characteristics, macroinvertebrates, and zooplankton. Fish populations are described with respect to their zoogeographic origins and the species composition of each lake. The relative degree of environmental change brought about by the activities of man in each lake is summarized. (Auth.)

15280. Toivonen, Jorma (Finnish Game and Fish. Res. Inst., Fish. Div., Helsinki, Finland). 1972. THE FISH FAUNA AND LIMNOLOGY OF LARGE OLIGOTROPHIC GLACIAL LAKES IN EUROPE (ABOUT 1800 A. D.). J. Fish. Res. Bd. Canada, 29(6): 629-637.

An attempt is made to give a general comparative survey of the conditions obtaining in the large oligotrophic European lakes before they were changed by human activity. The material is information from the available older literature concerning the quality of the water, the plankton, the benthic fauna, and the catches of fish. (Auth.)

15281. Beeton, A. M., and W. T. Edmondson (Center for Great Lakes Studies, Univ. of Wis., Milwaukee, Wisconsin). 1972. THE EUTROPHICATION PROBLEM. J. Fish. Res. Bd. Canada, 29(6): 673-682.

The trophic state of a lake is maintained by continued inputs of nutrients. In very large lakes the inshore environments are affected first by increased nutrient loading and, depending upon the morphology and morphometry, gradually the offshore waters are altered. The near-shore waters of Lake Michigan have greater concentrations of nitrogen and phosphorus and a lower silica content than open lake waters. Diatoms are more abundant inshore than offshore, the doubling times for diatom populations are shorter inshore, and species favored by nutrient-rich conditions are more abundant inshore. Data on plankton, nitrogen concentrations, and fish, from early studies on Lake Erie, show progressive changes from the shore lakeward and from the western basin eastward. (Authors)

15282. Behnke, Robert J. (Colo. Coop. Fish. Unit, Colo. State Univ., Fort Collins, Colorado). 1972. THE SYSTEMATICS OF SALMONID FISHES OF RECENTLY GLACIATED LAKES. J. Fish. Res. Bd. Canada, 29(6): 639-671.

The systematics of the subfamilies Salmoninae and Coregoninae of recently glaciated regions are reviewed. Interrelation between systematics and fisheries biology are stressed, pointing out the abundance of intraspecific genetic diversity of some salmonid fishes manifested in ecological and behavioral specializations, but not necessarily by morphological divergence. Innate, reproductive homing behavior of salmonid fishes may allow closely related populations to exist in sympatry and maintain reproductive isolation. Examples are cited to support the contention that many sympatric "sibling species" have evolved from a common ancestor in postglacial times. Closely related, sympatric populations are a major taxonomic problem, but this phenomenon which allows a species to consist of genetically discrete units with reproductive isolation between the stocks is of great significance for fisheries management. Postglacial salmonid communities are typically fragile and highly susceptible to disruption or destruction by introductions, eutrophication, and exploitation. Every effort should be made to protect the genetic diversity of a species. (Auth.)

15283. Loftus, Kenneth H., and Henry A. Regier (Ont. Dept. of Lands and Forests, Res. Branch, Maple, Ontario, Canada). 1972. INTRODUCTION TO THE PROCEEDINGS OF THE 1971 SYMPOSIUM ON SALMONID COMMUNITIES IN OLIGOTROPHIC LAKES. J. Fish. Res. Bd. Canada, 29(6): 613-616.

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